# IMPACT OF LEBANON BY-PASS 1950 TO 1963

OCT. 1964

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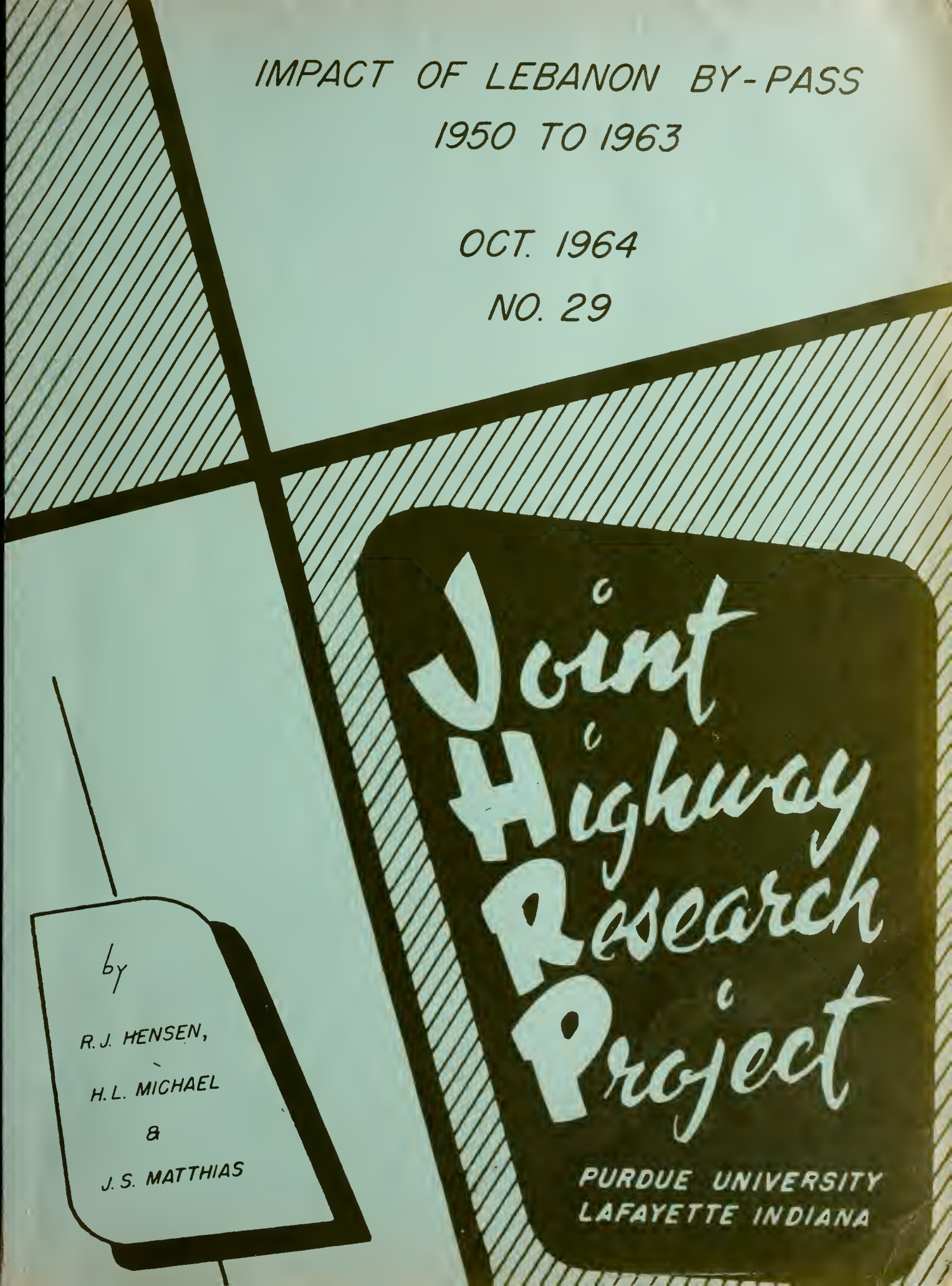


by

R. J. HENSEN,

H. L. MICHAEL

&

J. S. MATTHIAS

IMPACT OF LEBANON BY-PASS 1950 TO 1963

TO: K. B. Woods, Director
Joint Highway Research Project

October 28, 1964

FROM: H. L. Michael, Associate Director
Joint Highway Research Project

Project: C-36-64A
File: 3-5-1

The attached report "Impact of Lebanon By-Pass 1950 to 1963" is submitted as a Progress Report on the cooperative study, Highway Impact Studies. The report has been prepared from the data accumulated in this phase of this project over the last several years by several members of our staff. The report has been authored by Messrs. R. J. Hensen, H. L. Michael and J. S. Matthias.

Changes since 1950 as well as current trends are reported for land use, land value, traffic volume, travel time, and accidents. The effect of the reconstruction of this highway in 1960 to Interstate standards was important and several analyses of related problems are given.

Data collection in this area is continuing and another report is planned for the future.

The report is presented to the Board for the record and for review. It will also be submitted to the Bureau and to the State Highway Commission for review and comment.

Respectfully submitted,

Harold L. Michael

Harold L. Michael, Secretary

HLM:bc

Attachment

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Progress Report

# Highway Impact Studies:

# Impact of Lebanon By-Pass 1950 to 1963

by

R. J. Hensen, Research Assistant
H. L. Michael, Associate Director
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Joint Highway Research Project
Project: C-36-64A
File: 3-5-1

Prepared as Part of an Investigation

Conducted by

Joint Highway Research Project
Engineering Experiment Station
Purdue University

in cooperation with

Indiana State Highway Commission

and the

Bureau of Public Roads
U. S. Department of Commerce



Purdue University
Lafayette, Indiana
October 28, 1964

# TABLE OF CONTENTS

# LIST OF TABLES

# LIST OF FIGURES

# ABSTRACT

The purpose of this research was to determine the changes in land use, land values, and characteristics of highway travel caused by improvements to an urban By-Pass with complete access control. The 4.9 mile By-Pass section of I-65 around Lebanon, Indiana was selected for this research.

The results showed that only the property located within one-half mile of the By-Pass was appreciably affected by the reconstruction to interstate standards.

Analysis of right-of-way costs showed that if access control and/or grade separation will ever be warranted, then all required right-of-way should be included in the original taking.

Reconstruction of the By-Pass facility to interstate standards was followed by a substantial reduction in the accident rate and in travel time around Lebanon.

# INTRODUCTION

On July 1, 1960 a series of highway impact studies was initiated by the Joint Highway Research Project at Purdue University (1). The Project is tentatively scheduled to last for a period of at least ten years, during which time information on the effects of highway improvements on adjacent areas is to be studied. Included in the studies are changes in land use, land values, and characteristics of highway travel for several types of highway facilities. Such information should aid in more efficient, economical, and beneficial highway location and relocation in the future.

Six types of highway improvements were chosen to comprise the study areas. These facilities, all of which are major state arterials, are:

(a) An urban by-pass with complete control access;

(b) A rural highway with complete control of access;

(c) An urban by-pass with little or no control of access;

(d) A rural highway with little or no control of access;

(e) A bridge and its approaches in an urban area;

(f) A major highway interchange near a metropolitan area.

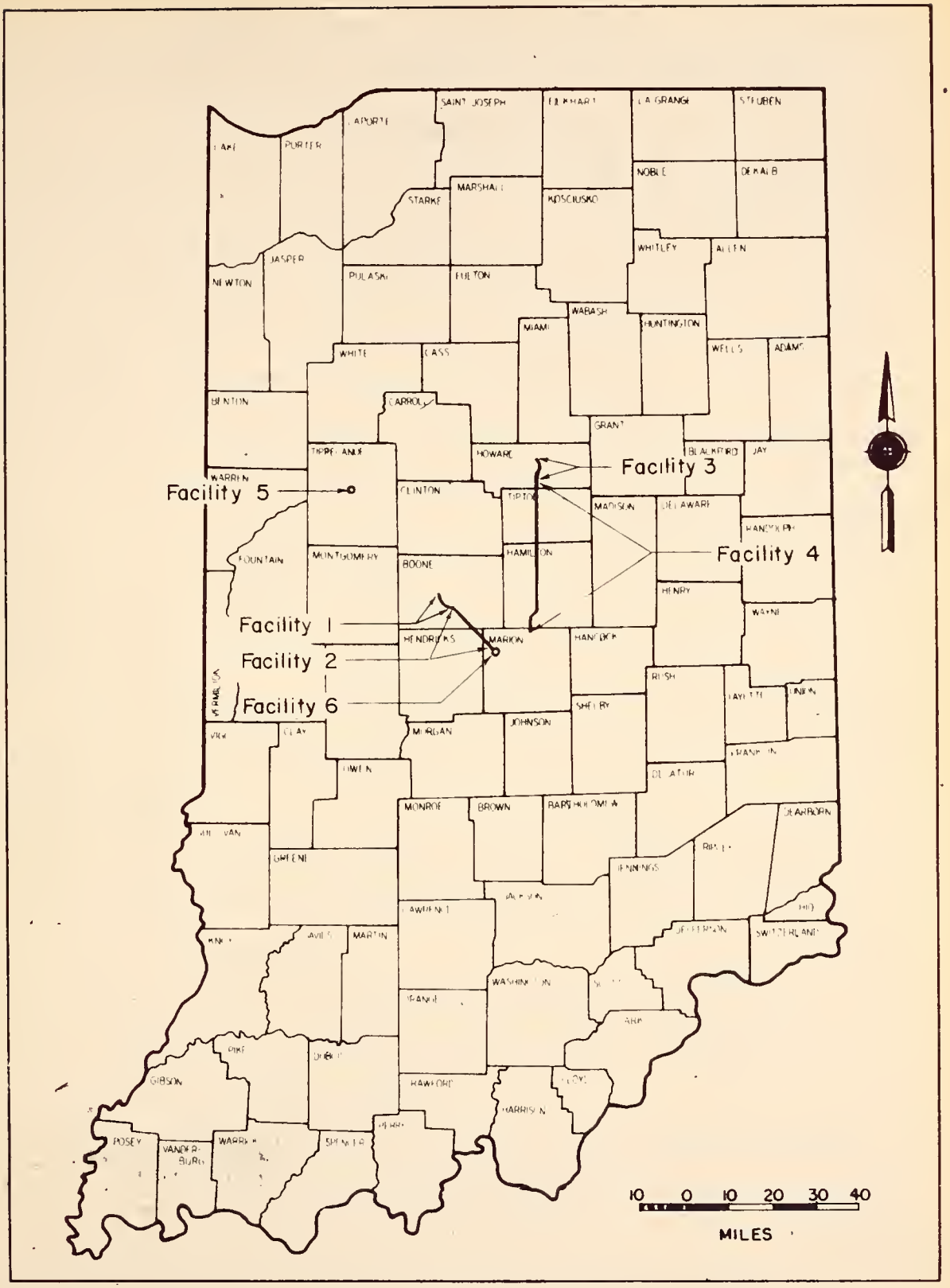
The specific facilities corresponding to the types of improvements listed above are (see Figure 1):

(a) The Interstate 65 by-pass around Lebanon, Indiana;

(b) A thirteen mile portion of Interstate 65 from the south end of the Lebanon By-Pass to the interchange with Interstate 465 northwest of Indianapolis, Indiana;

(c) The U. S. 31 by-pass around Kokomo, Indiana;

(d) U. S. 31 from the south end of the Kokomo By-Pass to the north edge of Marion County, Indiana;




LOCATION OF STUDY FACILITIES

**Figure 1**

(e) The U. S. 231 bridge over the Wabash River and connecting Lafayette and West Lafayette, Indiana;

(f) The interchange connecting Interstate 65 and Interstate 465 northwest of Indianapolis, Indiana.

Facilities a, b, and f are continuous portions of Interstate 65 extending from the north edge of Lebanon to approximately eight miles northwest of the central business district of Indianapolis. Facilities c and d are continuous portions of U. S. 31, extending from the north boundary of Kokomo to the north edge of Marion County.

A study of facility b was conducted and submitted as a progress report in June of 1961 (2,3).* A report on facility number e was completed in May of 1962 (4). Presently studies are being continued on all six facilities. This report is a discussion of the information obtained thus far on the area affected by facility number a, the Lebanon By-Pass of Interstate 65.

A complete study of highway economics, as recommended by the American Association of State Highway Officials, would give consideration to seven principal factors:

"(a) Solvency of a system or group of systems of highways;

(b) Land and community benefits from highways and their improvements;

(c) Costs of construction or improvement of highways;

(d) Costs of maintenance and operation of highways and their appurtenances;

(e) Direct benefit to road users in the form of reduced vehicle costs and savings in time on improved highways;

*Numbers in parentheses refer to listings in the Bibliography

(f) Benefits to road users in the form of increased comfort and convenience; and

(g) Benefits to road users in the form of over-all accident reduction." (10)

The study presented in this report has attempted to provide some information on five of the above factors for the Lebanon By-Pass. Factor (b) has been studied by evaluating land use and land value changes in the vicinity of the facility. Factor (c) is discussed with special emphasis on the expense incurred in purchasing additional right-of-way for the reconstruction. Benefits to the road users, as listed above in factors (e), (f), and (g), have been investigated by studying the trends in traffic volumes, travel times and delays and accident rate reduction on the reconstructed facility.

# THE STUDY AREA

## The City of Lebanon

The city of Lebanon is the county seat of Boone County, Indiana (see Figures 2 and 3). The corporate limits of the city includes approximately four square miles (see Figures 4, 5 and 6). The topography of the area can be described as flat to gently rolling, typical of the Wisconsin Ground Moraine that covers the central part of Indiana.

Lebanon is located approximately 27 miles northwest of Indianapolis on a primary-interstate highway (US 52 - Interstate 65). This route is the major highway connecting Chicago, Illinois, and points northwest with Cincinnati, Ohio, and points to the southeast. Two bus companies operate through bus service over this route with a total of 17 daily stops in Lebanon. In addition a third company provides daily commuter service to and from Indianapolis.

Two state highways, SR 39 north-south and SR 32 east-west, serve Lebanon. Rail service is provided by the New York Central and the Pennsylvania Railroads. Both have freight operations in the city. The New York Central provides the only rail passenger service; this service normally consists of one north-bound and one south-bound passenger train per day.

The population growth in Lebanon between the early 1920's and the early 1940's was relatively small. Near the end of World War II the population began to increase quite significantly and reached 9,500 by the year 1960 (see Figure 7). The 1960 figure represents a 25 percent increase over the 1950 population and a 45 percent increase over the 1940 population.

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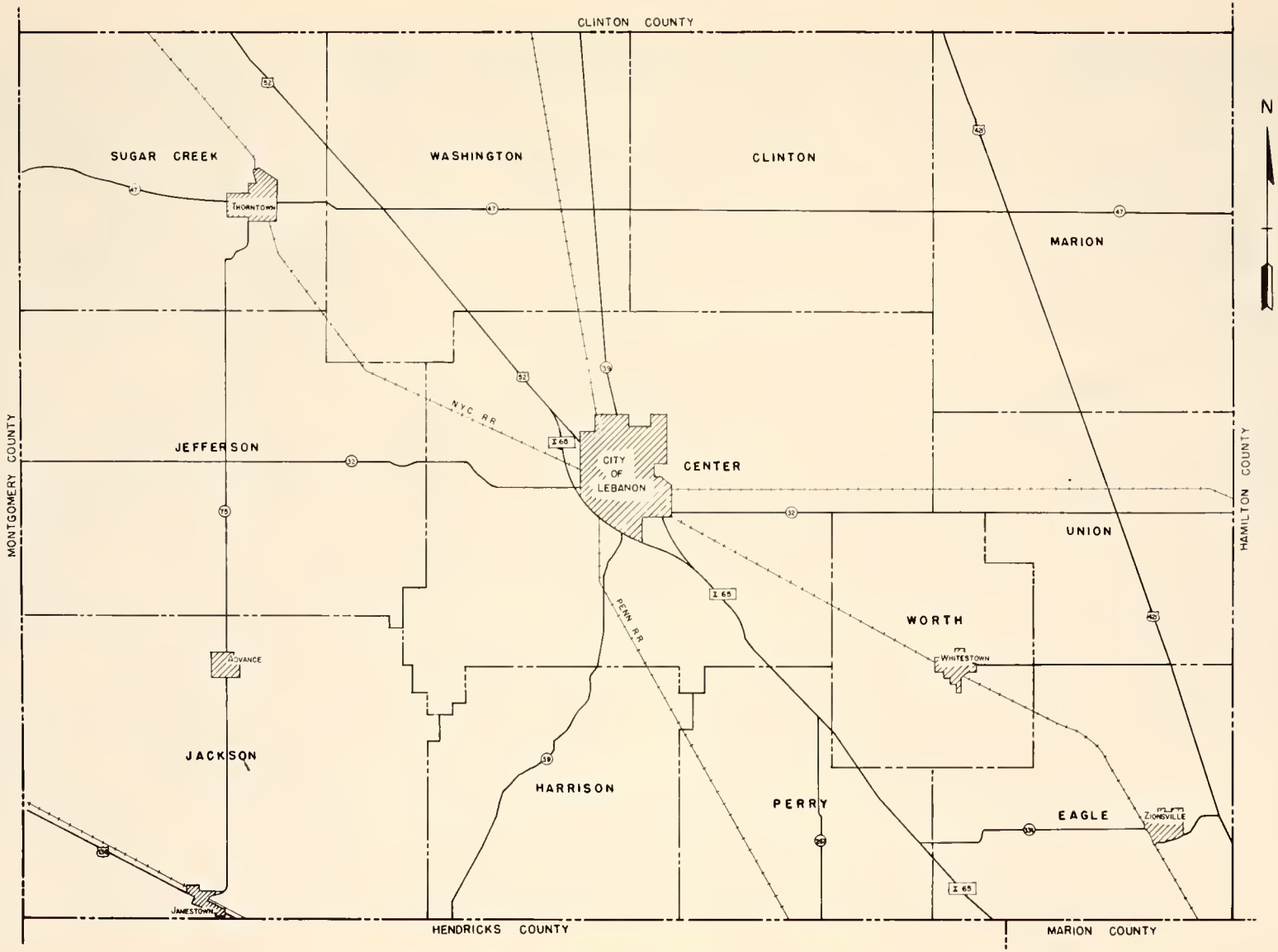
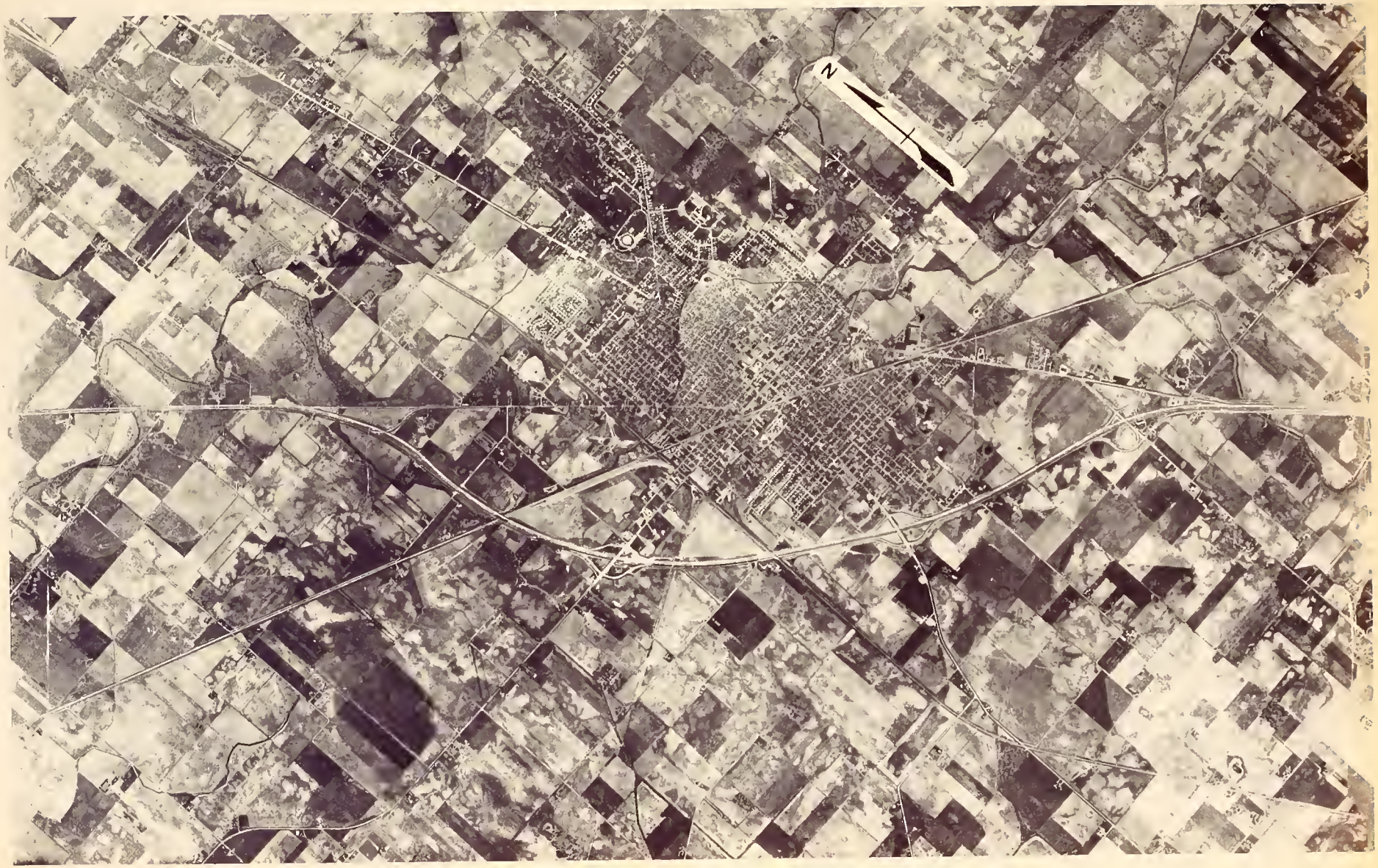
to increase [illegible] and reached 3,500 by the year 1960
(see Figure 7). This [illegible] a 25 percent increase over the
[illegible] 1940 population.

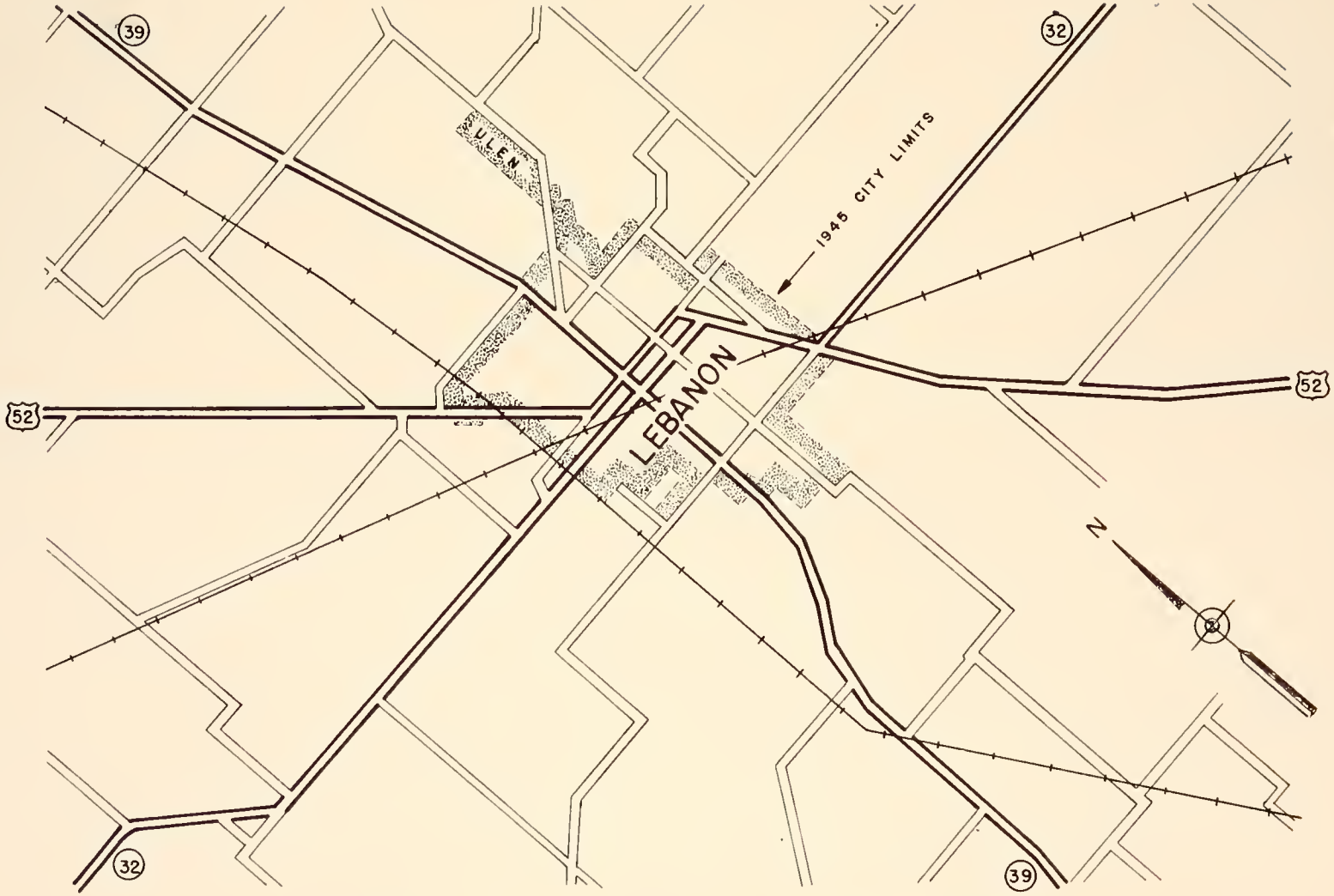



POLITICAL SUBDIVISION AND TRANSPORTATION NETWORK MAP OF BOONE COUNTY, INDIANA

FIGURE 2

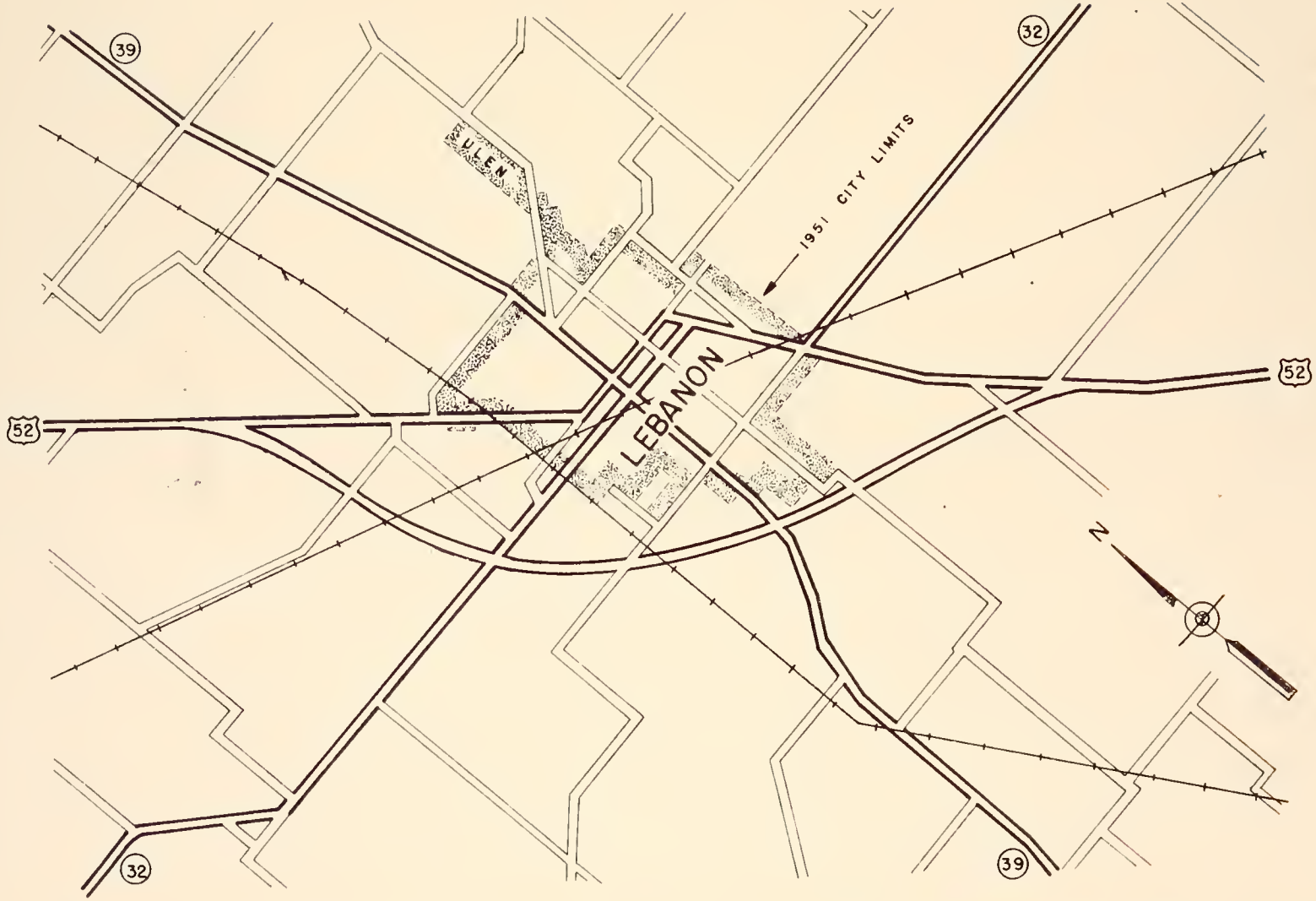



AIR PHOTO MOSAIC OF LEBANON AREA
PHOTOS TAKEN 4-22-60
FIGURE 3



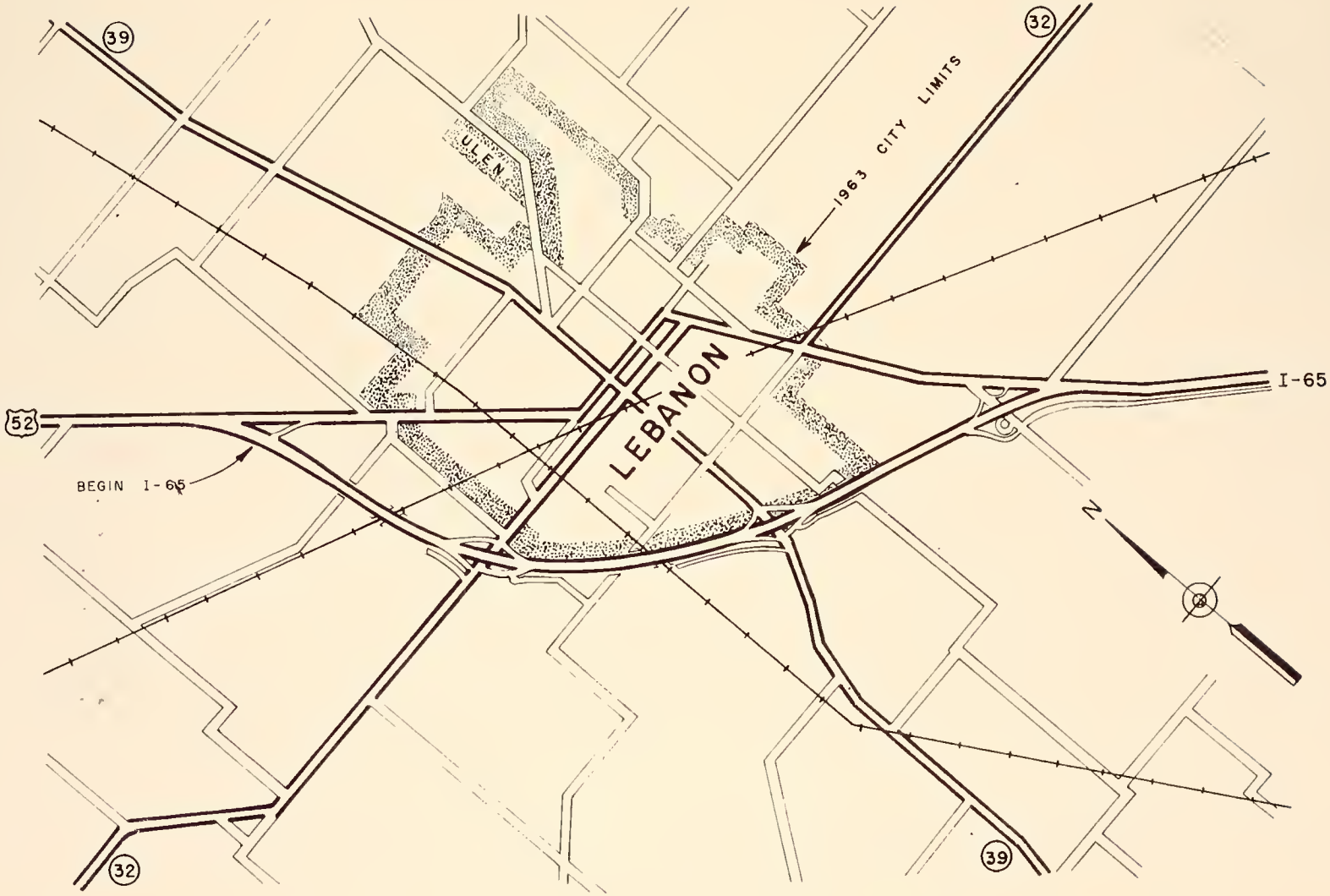

ROAD NETWORK IN THE VICINITY OF LEBANON, INDIANA, IN 1945

FIGURE 4



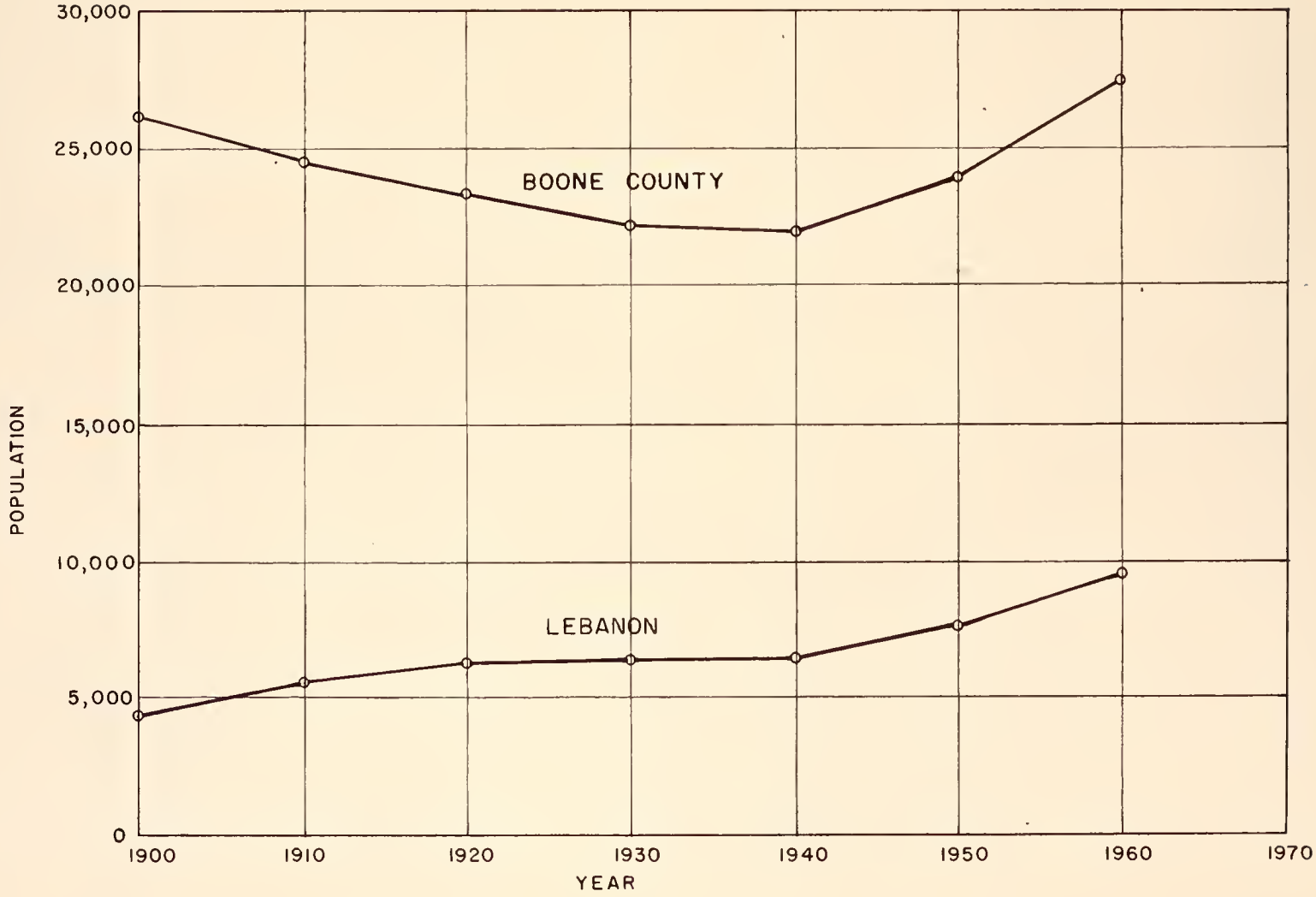

ROAD NETWORK IN THE VICINITY OF LEBANON, INDIANA, IN 1951

FIGURE 5




ROAD NETWORK IN THE VICINITY OF LEBANON, INDIANA, IN 1963

FIGURE 6




POPULATION GROWTH FOR THE CITY OF LEBANON, INDIANA AND BOONE COUNTY 1900 - 1970

FIGURE 7

The commercial activity within Lebanon is primarily oriented toward serving the surrounding agricultural area. There are however, a few small industries located in the city.

## Boone County

Boone County includes an area of 427 square miles; about 90 percent of this land area was classified as farmland in 1960. The county as a whole suffered a continuing decrease in population from the turn of the century until the early 1940's. In the early 1940's the population began to increase and reached 24,000 in 1950 and 27,500 in 1960 (see Figure 7). The 1960 census listed 76 percent of the population residing in incorporated areas.

Table 1 gives a general breakdown of the county statistics with relation to population distribution, income, employment, and housing. Table 2 gives the general breakdown of similar state statistics. Table 3 is a comparison of change in Boone County and in the state as a whole. It can be seen from this table that while population, income, and retail trade in the county have been keeping pace with the state, manufacturing and wholesale trade have not.

## The I-65 By-Pass

The first by-pass around Lebanon was opened in May of 1951. Its purpose was to route through traffic on U. S. highway 52 around rather than through the city (see Figure 5). Sufficient right-of-way was acquired at the time of the improvement by the state for construction of a non-limited access four-lane divided highway. However, traffic volumes at the time of construction were such as to warrant completion of only two lanes.

TABLE 1

BOONE COUNTY STATISTICS

| | 1940 | 1945 | 1950 | 1954 | 1960 |
|---|---|---|---|---|---|
| Portion of land in farms | | | | 94% | 90% |
| number of commercial farms | | 1,964 | | 1,824 | 1,208 |
| percent tenant operated | | 31% | | 26% | 25% |
| number of part-time farms | | | | 160 | 335 |
| Population | 22,100 | | 24,000 | | 27,500 |
| Percent residing on farms | 41% | | | | 24% |
| Percent residing in City of Lebanon | 30% | | 32% | | 35% |
| Number of families | | | 6,790 | | 7,360 |
| Median family income | | | $2,910 | | $5,400 |
| (with price index corrected in 1960) | | | ($3,610) | | |
| Total number in labor force | | | 9,110 | | 10,400 |
| percent male | | | | | 71% |
| percent employed in agriculture | 40% | | 29% | | 14% |
| percent employed in manufacturing | | | 19% | | 26% |
| percent employed wholesale and retail trade | | | | | 18% |
| percent who work outside Boone County | | | | | 31% |
| percent who are white collar workers | | | | | 38% |
| Employers reporting under social security: | | | | | |
| number of firms | | | | 448 | |
| number of employees | | | | 3,343 | 3,524 |
| Housing units: | | | | | |
| total occupied | | | 7,631 | | 8,570 |
| percent owner occupied | | | 65% | | 71% |
| median value of owner occupied | | | | | $9,700 |
| percent renter occupied | | | 35% | | 29% |
| median gross monthly rent | | | | | $70 |

TABLE 1 (Continued)

| | 1948 | 1954 | 1960 |
|---|---|---|---|
| Retail trade: | | | |
| number of establishments | 288 | 252 | 309 |
| sales ($1000) | $23,042 | $24,662 | 31,800 |
| (price index corrected to 1960 dollars) | ($28,342 | $27,156 | ----- |
| number of paid employees | 1,041 | 974 | 1,155 |
| Wholesale trade | | | |
| number of establishments | 29 | 47 | 41 |
| sales ($1000) | $6,824 | | 4,845 |
| (price index corrected to 1960) | ($7,820) | | |
| number of paid employees | 109 | 317 | 233 |
| Manufacturing | | | |
| number of employers | 27 | 42 | 38 |
| number of employees | 1,425 | 1,668 | 1,559 |
| Bank deposits | | | |
| Total ($1000 | $13,078 | $18,963* | $18,587 |
| (price corrected to 1960) | ($16,085 | ($20,641 | |
| time deposits | $2,675 | $3,448* | $3,327 |
| (price corrected to 1960) | ($3,290) | ($3,753) | |

*For the year 1956

TABLE 2

STATISTICS FOR THE STATE OF INDIANA

| | 1950 | 1954 | 1960 |
|---|---|---|---|
| Population | 3,934,000 | | 4,662,000 |
| Number of families | 1,039,000 | | 1,198,000 |
| Median family income | 3,200 | | 5,800 |
| price index corrected to 1962 | 3,970 | | |
| Total number in labor force | 1,518,442 | | 1,717,241 |
| Employees reporting under social security: | | | |
| number of firms | | 73,533 | 80,087 |
| number of employees | | 1,207,000 | 1,149,400 |
| Housing units - total occupied | 1,168,916 | | 1,387,878 |
| Retail trade: | | | |
| number of establishments | | 41,624 | 45,904 |
| sales ($1000) | | 4,512,673 | 5,176,591 |
| (price index corrected to 1960) | | 4,969,710 | |
| number of paid employees | | 196,000 | 210,800 |
| Wholesale trade: | | | |
| number of establishments | | 5,881 | 6,697 |
| number of paid employees | | 52,820 | 58,800 |
| Manufacturing: | | | |
| number of employers | | 6,355 | 6,556 |
| number of employees | | 582,800 | 544,347 |
| Bank deposits: | | | |
| total deposits ($1000) | | 4,124,720* | 4,598,562 |
| price index corrected to 1960 | | 4,489,739 | |
| time deposits ($1000) | | 1,225,236* | 1,484,357 |
| price corrected to 1960 | | 1,333,664 | |

*for the year 1956

TABLE 3

COMPARISON OF PERCENTAGE CHANGE FOR BOONE COUNTY
AND THE STATE OF INDIANA FROM EARLY 1950's to 1960

| | Boone County | Indiana |
|---|---|---|
| Population | + 14.6 | + 18.5 |
| Number of families | + 8.4 | + 15.3 |
| Median family income | + 49.6 | + 46.1 |
| Total number in labor force | + 14.2 | + 13.1 |
| Employees reporting under social security: | | |
| Number of firms | + 8.2 | + 8.9 |
| Number of employees | + 5.4 | + 9.5 |
| Total number of housing units occupied | + 12.3 | + 18.7 |
| Retail trade: | | |
| number of establishments | + 22.6 | + 10.3 |
| number of employees | + 18.6 | + 7.6 |
| sales | + 28.9 | + 14.7 |
| Wholesale trade: | | |
| number of establishments | - 12.8 | + 13.9 |
| number of employees | - 29.7 | + 11.3 |
| Manufacturing | | |
| number of establishments | - 14.3 | + 3.2 |
| number of employees | - 6.5 | - 6.6 |
| Bank deposits: | | |
| total deposits | - 10.0 | + 11.5 |
| time deposits | - 11.4 | + 11.3 |

The development of the Interstate system in Indiana resulted in a decision by the State Highway Commission to reconstruct the U. S. 52 By-Pass to Interstate standards as a portion of Interstate Route 65. This decision required the purchase of additional right-of-way as well as all access rights to the By-Pass. The reconstructed facility was completed early in 1960. (see Figure 6).

## PREVIOUS STUDIES

In 1947, a travel time study (6) was made of the traffic on U. S. highway 52 at Lebanon. The purpose of the study was to determine the average time required to drive through the city and also to determine the percentage of vehicles that stopped in Lebanon. The study was conducted by the license plate-time recording technique, using two external cordon stations. It was initiated in anticipation of a proposed by-pass, and the results indicated that such a facility would be beneficial to through traffic.

In 1950 a study (7) was initiated of the economic and traffic aspects of the Lebanon By-Pass. This study was conducted in conjunction with another By-Pass study at Kokomo. The study was made "before" and "after" the facility was opened to traffic. Data on the traffic movement was obtained by two external-type origin-and-destination surveys and supplementary volume counts. One of the surveys was conducted prior to the opening of the By-Pass and the second was performed approximately six months after the facility was opened to traffic.

The "before" study indicated that 59 percent (approximately 4000 vehicles per day) of the traffic approaching Lebanon desired to pass through the city. The "after" study indicated that approximately 94 percent of the through traffic did use the By-Pass.

Additional information from travel time studies indicated considerable savings to through motorists in terms of operating costs and time. The benefit-cost ratio of the facility constructed in 1951 was computed to be 2.61.

In 1957 a study (8) was conducted to evaluate the operational efficiency of the By-Pass and to determine the long-range economic effect of the facility on the city of Lebanon. Again, as in 1950, the study was made in conjunction with a similar study at Kokomo. By-Pass travel times and accident rates were used as a criteria of operational efficiency and the economic effects were studied in terms of the changes in land values, land use, and business activity.

The study indicated that operational efficiency was inadequate and that the observed increase in By-Pass travel time and a large percentage of the accidents were due to the lack of access control. Difficulty, however, was encountered in attempting to relate land use changes to the By-Pass. One of the reasons for this difficulty was that elevated railroad right-of-way separates the city from the By-Pass and apparently influenced the effect of the By-Pass on land use.

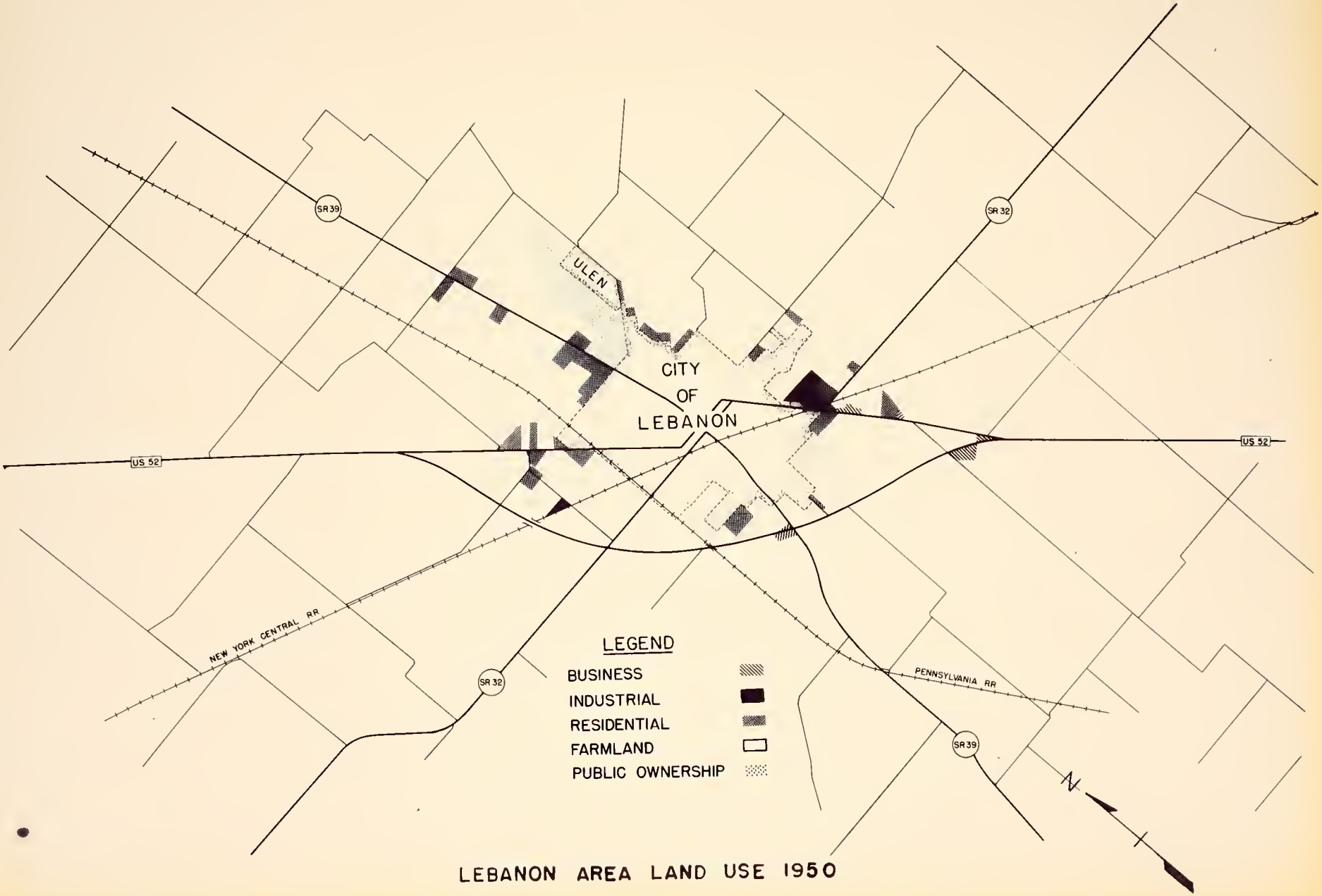
## LAND USE

In attempting to determine the economic effects of a traffic facility such as a by-pass on the adjacent areas, one of the factors that is measured is land use and land use change. The variety of influences that are active in most communities make it very difficult to sort out those that can be directly attributed to the facility. The analysis of land use is divided into two parts in this study. The first is a study of the Lebanon area as a whole considering its expansion from the 1945 city limits. The second part is a study of the changes that have occurred adjacent to the By-Pass. By making this double analysis the changing patterns of the By-Pass area due to the effect of the By-Pass may be distinguishable.

The land use patterns analyzed in the study were obtained from airphotos of the area and existing land use maps. Verification of the patterns was obtained, where possible, from previous reports on the By-Pass and by field checking the existing land uses.

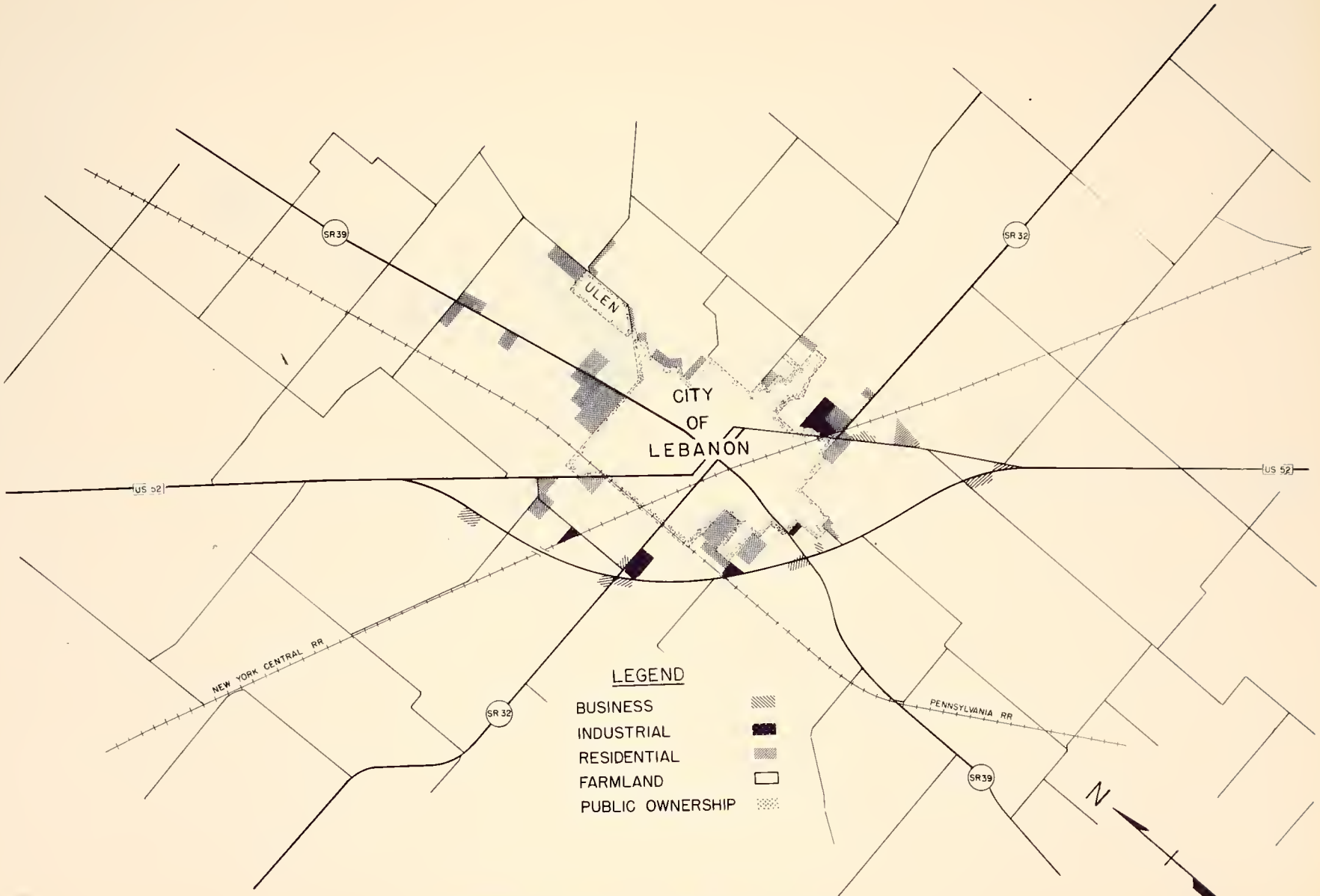
The land use shown in Figure 8 existed in 1950 at the time that the By-Pass was being constructed. Development along the By-Pass route was beginning to occur. One area of industrial development existed on the south side of the city. Residential development was beginning to appear outside of the city limits, with most of it occuring along State Route 39 north and south of the city and along the U. S. 52 business route north of its underpass of the Pennsylvania Railroad.

By 1955 development of residential tracts, as shown in Figure 9, was continuing on both the north and south ends of the city. A large development was started south of the city between State Route 39 and the Pennsylvania



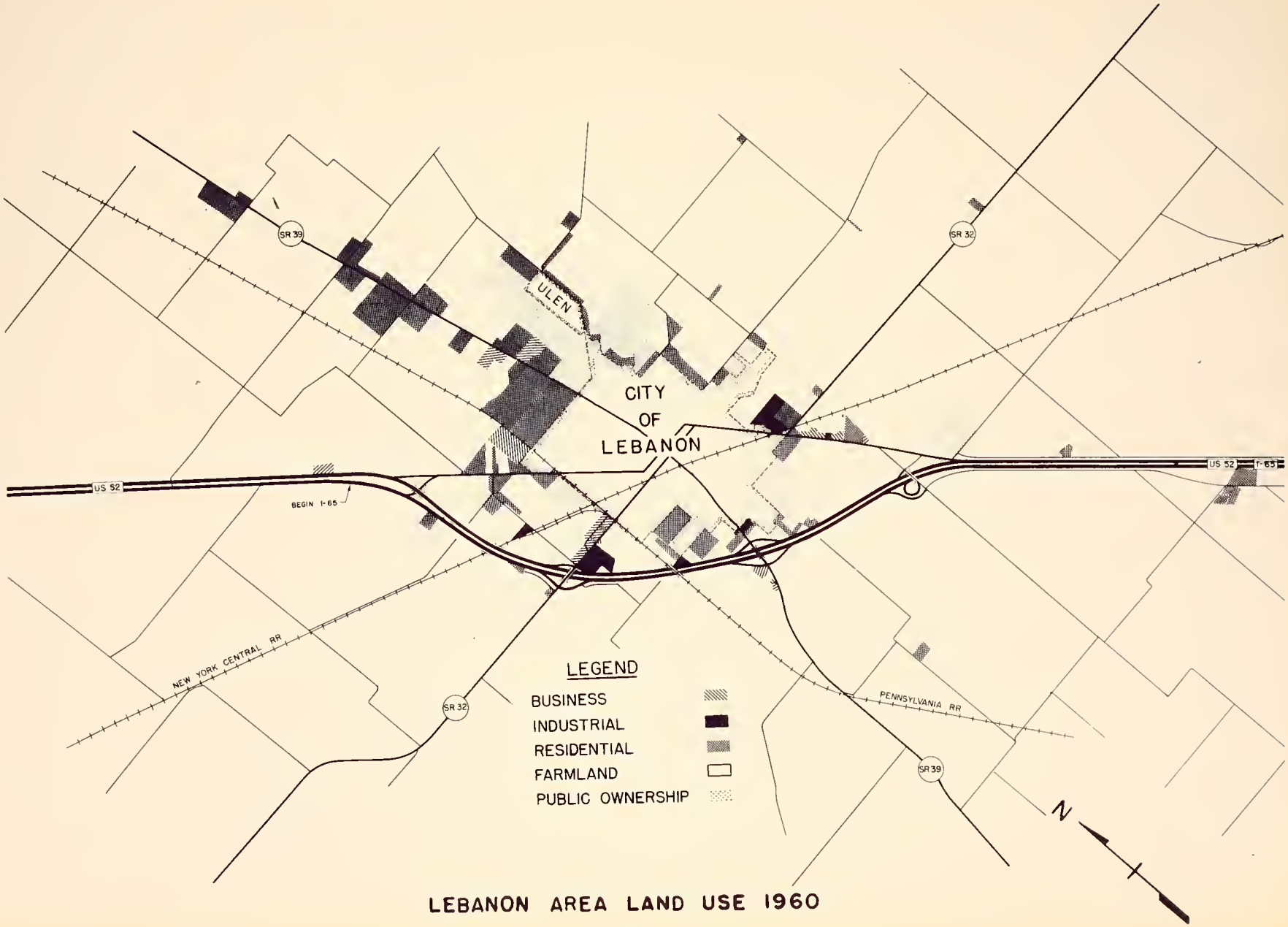

LEBANON AREA LAND USE 1950

FIGURE 8




LEBANON AREA LAND USE 1955

FIGURE 9




LEBANON AREA LAND USE 1960

FIGURE 10

Railroad. This area is immediately adjacent to the north side of the By-Pass. Another noticeable addition occurred north and east of Ulen, a small village located north of Lebanon. Several new industrial sites were located on the west side of the city, adjacent to the By-Pass. Development along the By-Pass was primarily oriented to highway service.

By 1960 a considerable change in the land use pattern had taken place (see Figure 10). Residential development was concentrated primarily north along State Route 39. Some additional development occurred on the south side, but the By-Pass appeared to have become a barrier to further expansion to the south. Lack of new residential development west of the Pennsylvania Railroad was quite noticeable. This can most probably be attributed to the earth embankment acting as a natural barrier. Commercial development west of the city along State Route 32 was also quite noticeable. No additional industrial sites were evident but there was an extension of the existing site at the State Route 32 interchange with the By-Pass.

## By-Pass Land Use

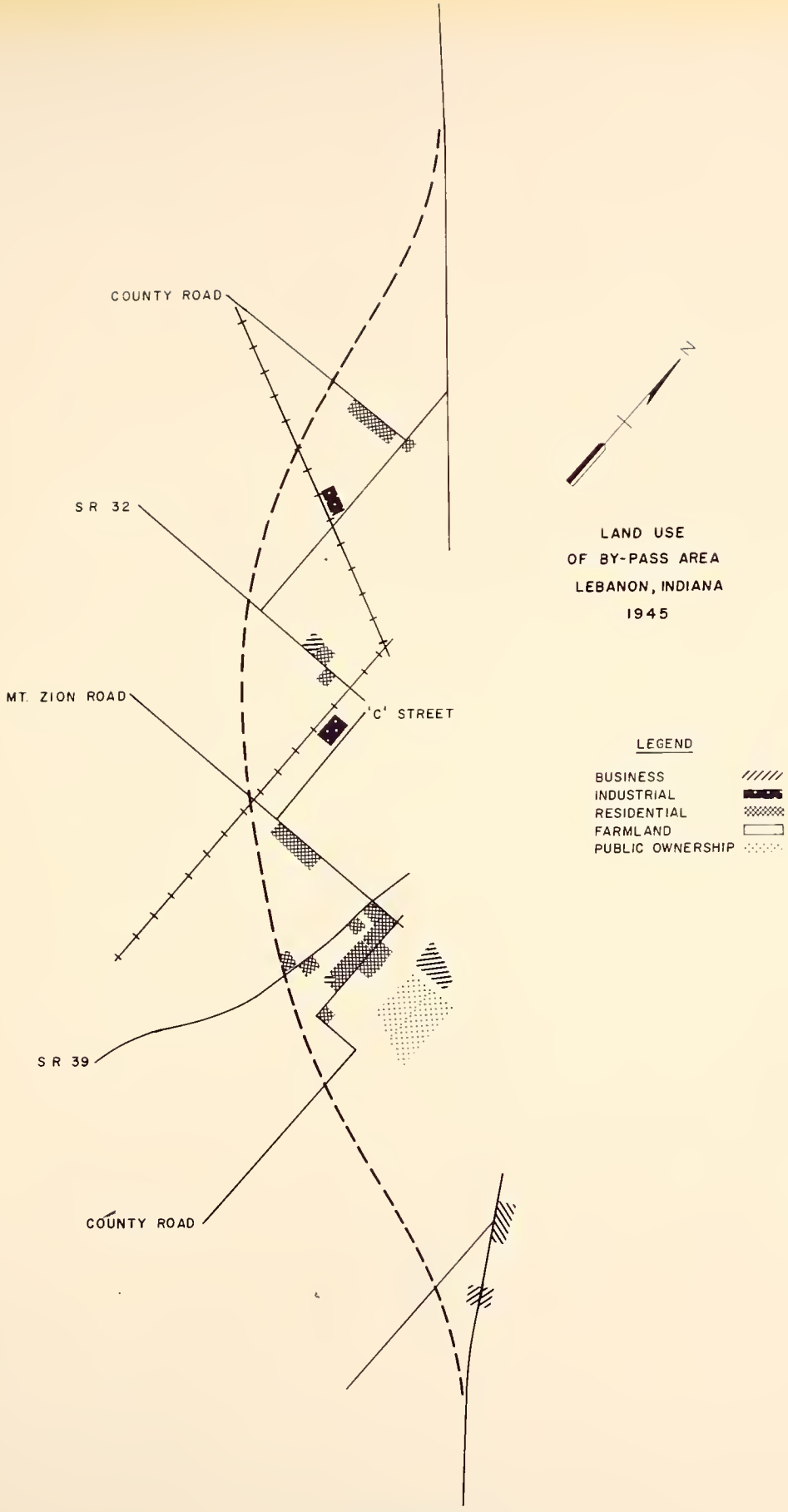
In 1945, before the by-pass was considered, the area presently occupied by the facility was essentially rural in nature. The majority of the land was being used for agricultural purposes. There were several small residential developments extending along the two State Highways as shown in Figure 11. Two industrial sites were located in the immediate area, but their location appears to have been in relation to the railroad.

By 1951, immediately following the opening of the By-Pass, a number of highway oriented businesses had been started (see Figure 12). Among these were three service stations, two restaurants, one motel, and a farm implement sales agency. Two more industrial sites were also added along State Route 32 in the vicinity of the By-Pass. Residential land use changes were apparently influenced by the natural growth of the City, as little change other than extension of established developments occurred.

The land use in 1957 indicated that the By-Pass oriented business was continuing to develop, but at a slower rate than the initial buildup. One additional motel, a restaurant, three service stations, and an automobile sales agency were added (see Figure 13). No apparent expansion of industrial sites occurred during this period. Residential land use continued to approach the By-Pass, but the major pattern continued to show only an extension of development along State Route 39.

By 1963 the By-Pass was completely reconstructed as a limited access facility as shown in Figures 14, 15, 16, and 17. A number of land use changes occurred because of the reconstruction (see Figure 18).

One motel and a service station were abandoned because access to the By-Pass was removed (see Figure 19). Interchange construction removed five service stations, two restaurants, and an auto sales agency (see Figure 20). Also removed and reconstructed on the remainder parcel was a farm implement sales agency. Access to the remaining motel was considerably restricted as shown in Figure 21. A restaurant located on the south end of the By-Pass closed two years after the limited access facility was completed but has since been rented as a lodge for a local fraternal organization (see Figure 22). The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LAND USE
OF BY-PASS AREA
LEBANON, INDIANA
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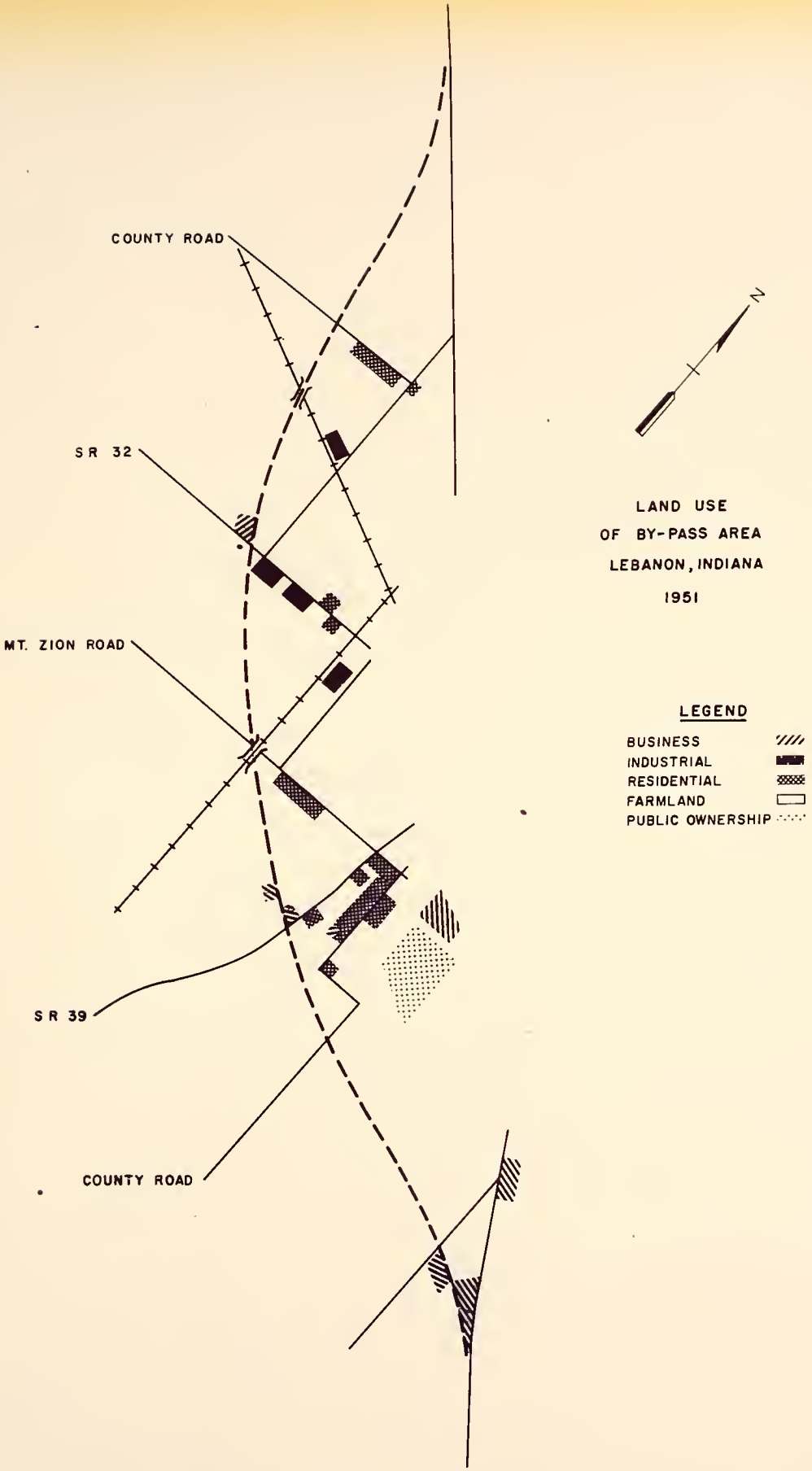
FARMLAND
PUBLIC OWNERSHIP

FIGURE 11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LAND USE
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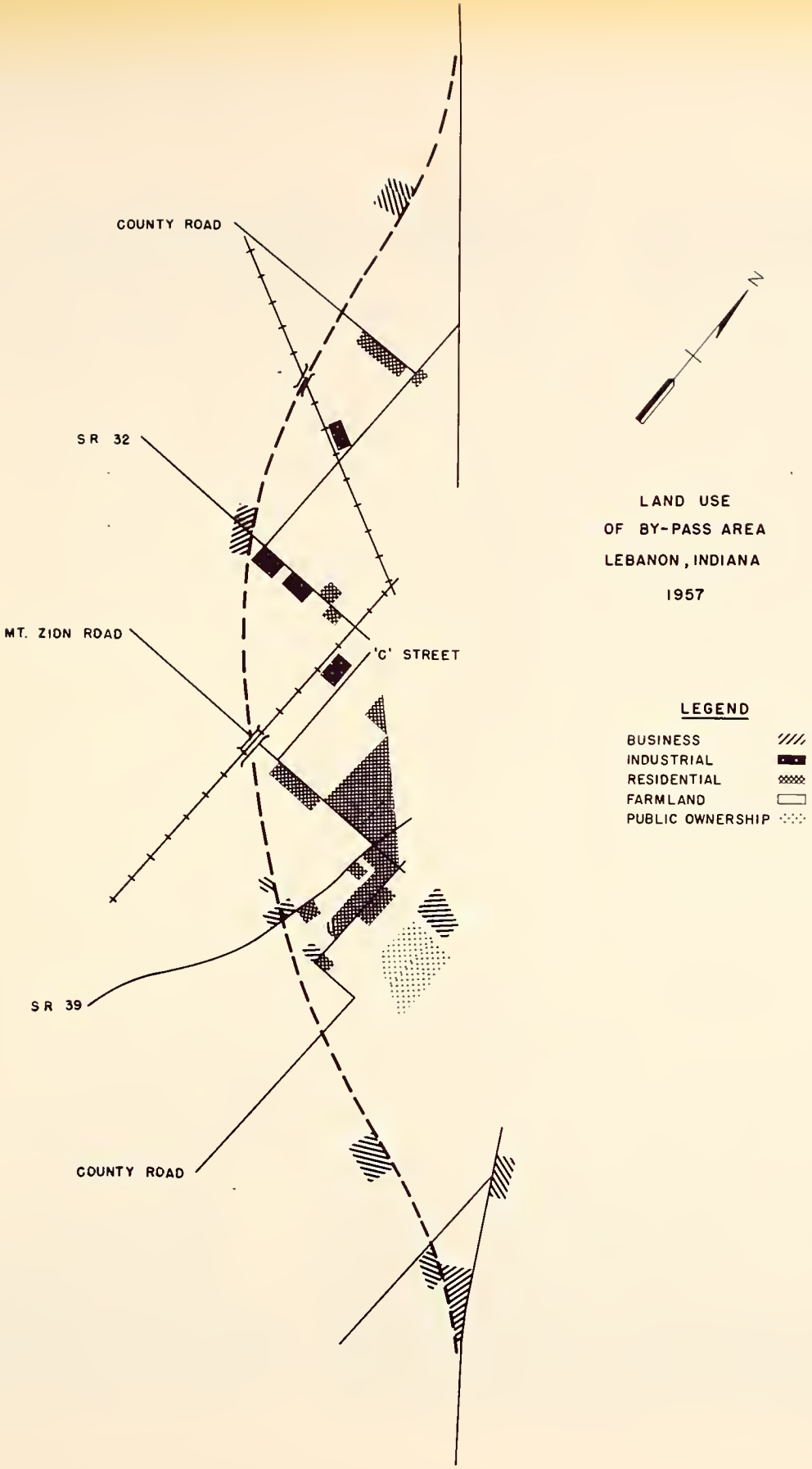
FIGURE 12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RESIDENTIAL
FARMLAND
PUBLIC OWNERSHIP

FIGURE 13


I 65-BUSINESS LOOP INTERCHANGE NORTHWEST OF LEBANON

PHOTO TAKEN APRIL 1963

FIGURE 14


I 65 - SR 32 INTERCHANGE WEST OF LEBANON

PHOTO TAKEN APRIL 1963

FIGURE 15


I 65 - SR 39 INTERCHANGE SOUTH OF LEBANON

PHOTO TAKEN APRIL 1963

FIGURE 16


I65— BUSINESS LOOP INTERCHANGE SOUTH EAST OF LEBANON

PHOTO TAKEN APRIL 1963

FIGURE 17

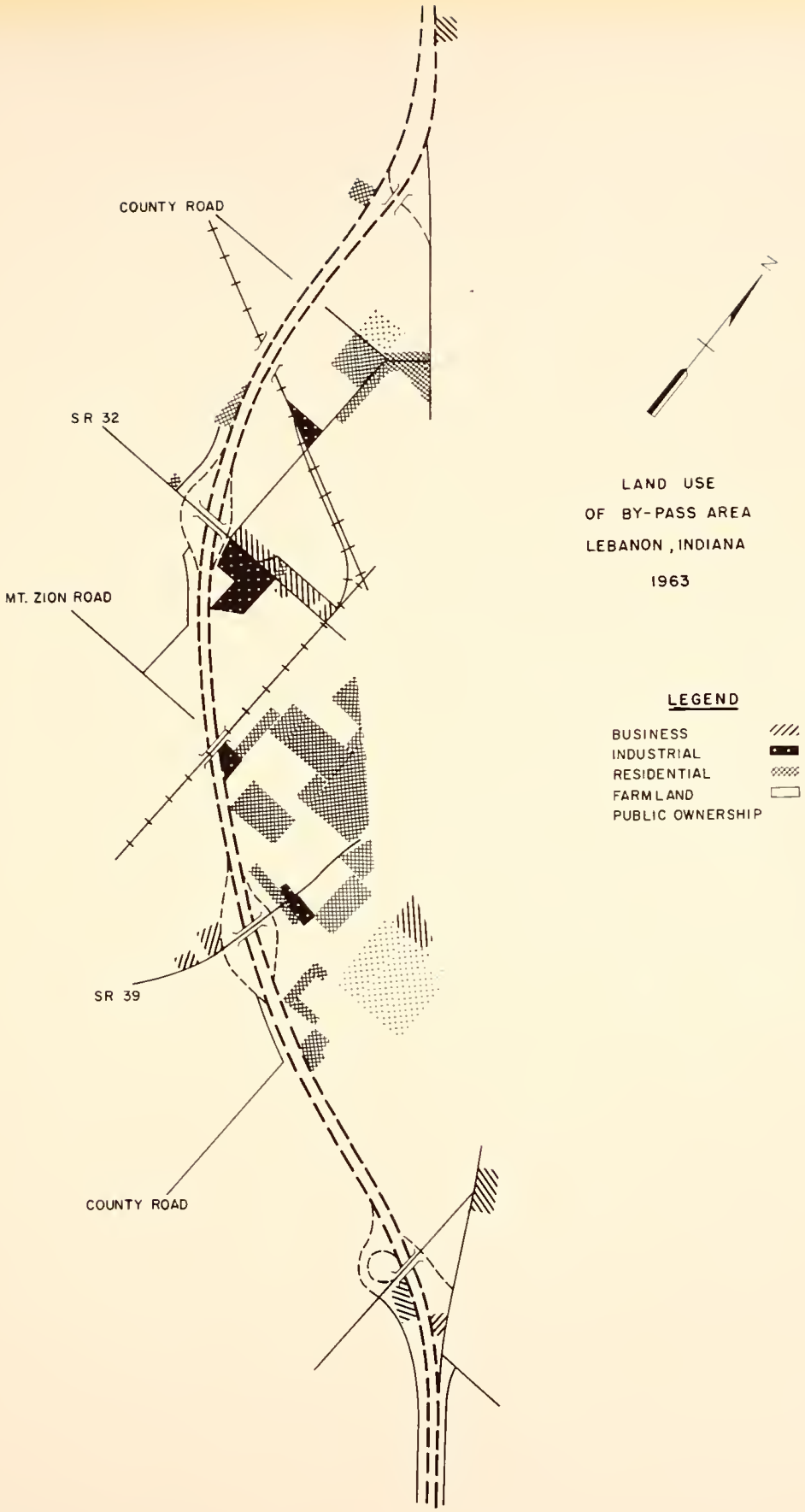

COUNTY ROAD
SR 32
MT. ZION ROAD
SR 39
COUNTY ROAD
N
LAND USE
OF BY-PASS AREA
LEBANON, INDIANA
1963
LEGEND
BUSINESS
INDUSTRIAL
RESIDENTIAL
FARMLAND
PUBLIC OWNERSHIP

FIGURE 18

locations of these facilities can also be seen on Figures 27, 28, 29 and 30 in the section on reconstruction costs.

A restaurant was opened on State Route 39 south of the By-Pass after the reconstruction. A trailer court was also opened along this route immediately north of this By-Pass interchange. Figure 23 shows several service stations which have opened near the By-Pass.

The industrial sites at the State Route 32 interchange have expanded, along with continued development of commercial sites along the State Route between the City and the By-Pass. Some of this development is undoubtedly related to the annexing of the area by the City.

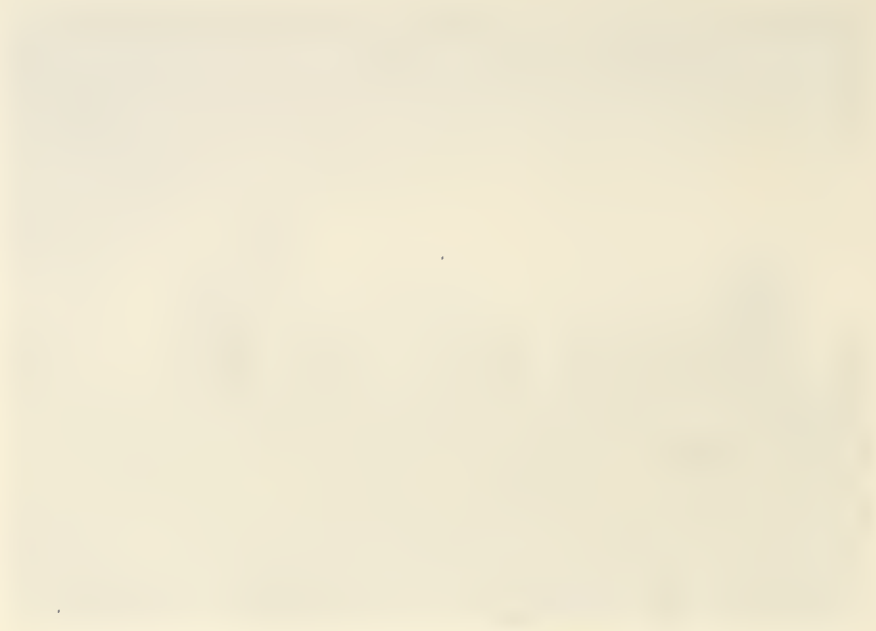
Residential land use south along State Route 39 appears to have been stopped by the By-Pass, as little development has occurred in recent years. The limited access facility also appears to have blocked further expansion of residential development south of the City. The earth embankment of the Pennsylvania Railroad as shown in Figure 24 appears to have been a barrier to expansion of much of the area By-Pass. Development which has occurred west of the railroad has in general been limited to strip development along State Route 32.

SERVICE STATION ABANDONED ON SOUTH END OF BY-PASS

MOTEL CLOSED ON NORTH END OF BY-PASS

BUILDING VACATED WHEN ACCESS WAS RESTRICTED

FIGURE 19



SERVICE STATION LOCATED AT THE SR 32 INTERSECTION PRIOR TO "TAKING"


SERVICE STATION AND RESTAURANT LOCATED AT THE SR 39 PRIOR TO "TAKING"

BUSINESSES TAKEN FOR THE ADDITIONAL R/W REQUIRED FOR THE INTERCHANGES

FIGURE 20

MOTEL WITH TWO DIRECT ENTRANCES PRIOR TO RE-CONSTRUCTION.

MOTEL WITH DIRECT ACCESS REMOVED BY RE-CONSTRUCTION. ENTRANCE FROM REAR.

MOTEL LOCATED ON SOUTH END OF BY-PASS

FIGURE 21

RESTAURANT CLOSED BECAUSE OF ACCESS RESTRICTION (1961)

BUILDING RENTED TO LOCAL FRATERNAL ORGANIZATION (1963)

BUILDING USE CHANGED BECAUSE OF ACCESS RESTRICTION

FIGURE 22

SERVICE STATION ON NORTH END OF BY-PASS

SERVICE STATION EAST OF BY-PASS ON SR 32

NEW SERVICE STATIONS BUILT SINCE THE BY-PASS RECONSTRUCTION

FIGURE 23


RAILROAD EMBANKMENT ALONG WEST EDGE OF LEBANON

PHOTO TAKEN APRIL 1963

FIGURE 24

## LAND VALUE

A major problem in highway improvement is that of acquisition of needed right-of-way. Property owners whose parcels are located in the path of a new facility or adjacent to an improved facility must be compensated for their loss. In past years it has been very difficult to determine what defines "just" compensation. The property owner usually feels that the damage his parcel sustains is high. The limited history available on earlier takings seems to indicate that while some parcels are permanently damaged, others receive substantial enhancement because of the highway facility.

A number of studies are now being conducted in various states to determine what factors influence the value of remainder parcels. Such a study was completed in the State of Indiana in September of 1963, (5). These studies evaluated only the remainder parcels. In attempting to infer what economic effects a particular facility has on an area, it is necessary to consider not only remainder parcels, but also all other parcels that may have been effected.

In studying the land values of the parcels in the vicinity of the By-Pass it was necessary to obtain information on the sale of all parcels in that area. Such information was obtained from the deed record books in the Boone County Recorder's office. Data was obtained for an eighteen year period, from 1945 to 1963. Size and description of each parcel were obtained from the text of the deeds. Sale price was inferred from the federal revenue stamps recorded on the deed. *

---

*A Study made as a part of a previous report (2) showed a close correlation between the value indicated by the stamps and by purchasers of property in that study area.

In obtaining the data, careful notice of each sale was made in an attempt to eliminate those sales that appeared to be either forced or to relatives. The values used were for land only, as the value of all improvements was excluded. The transactions were then tabulated by dollar amount, size of parcel, and proximity to the By-Pass. These tabulations are summarized in Table 4. The bands shown in the table refer to the distance between the center of the parcel and the facility as shown below:

| Band | Distance from facility (miles) |
|---|---|
| A | 0 - 1/2 |
| B | 1/2 - 1 |
| C | 1 - 1-1/2 |
| D | Beyond 1-1/2 |

The number of sales occurring in any one year was very small, consequently they were grouped into six-year periods in an attempt to avoid weighting the trend with one exceedingly large or small unit price. Parcels of all sizes were included. It was also assumed in this analysis that the value of all land in a band was equal to the mean price per acre paid for land within the band. It is realized that this may not be true but such an assumption was necessary in order to make a meaningful analysis.

In attempting to evaluate the relative changes in the bands, the mean value per acre of the bands for each of the year groups was determined. Figure 25 is a plot of the trends in land values in the several bands over the eighteen year study period as determined from sales of property.

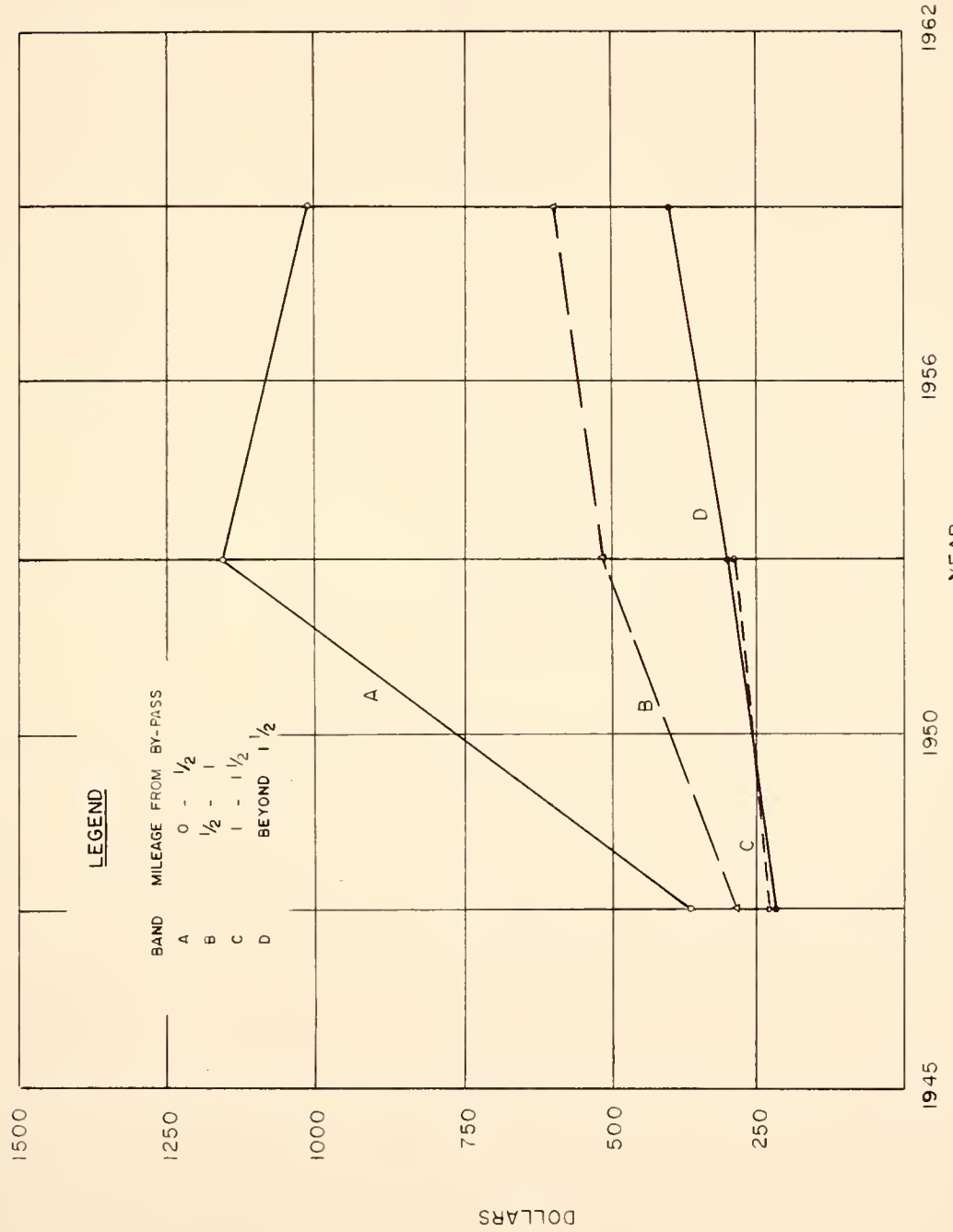
Even though the By-Pass was not completed in the period 1945-1950, the location of the facility had been known for a number of years. As a result it is not surprising that the value of land as noted from sales in this period decreased as distance from the By Pass increased. Any effect, however, appears to have been limited to land within one mile of the centerline of the By Pass (Bands A and B).

Following construction of the original By Pass, the value of land within one-half mile (B and A) increased in value. The increase as noted from sales during the next six years was about threefold. On the other hand land values farther from the By Pass appear to have enjoyed only the increase in value appropriate to the region as assumed from the increase noted for Band D.

The sharp increase for Band A during 1951-1956 can most probably be attributed to the purchase of several commercial sites for service stations, restaurants, and motels. Sales of property within this band, however, were for a smaller mean value during the six years (1957-62) after the date that right-of-way was initialy purchased for the reconstruction of the facility to interstate standards. This value, however, was still considerably higher than land more distant from the facility.

No data are given for Band C for the period 1957-62 because only four small residential-size lots were sold in this Band area in this period. As a result, the sample size was so small that the acreage was not representative of all land within the band.

A second method of evaluating land value change was also considered in this study. The use of actual sales as a measure of value of a band tends to weight only those parcels that seem to have potential for development. For this reason it was thought that assessed property valuation might be a more critical measure of change. Table 5 shows the total assessed valuations in Boone County for the beginning and the end of the study period. It was first thought that Center Township might provide control information, in that it comprises the area denoted as band "D" in the previous analysis.




MEAN VALUE OF AN ACRE OF LAND ALONG BY-PASS

FIGURE 25

# TABLE 4

Years 1945-50

| Band | Sale Price Per Acre (Dollars) | | No. of Sales |
|---|---|---|---|
| | Mean Value Per Acre | Range | |
| A | 370 | 130 - 3480 | 26 |
| B | 288 | 145 - 2270 | 23 |
| C | 230 | 75 - 635 | 9 |
| D | 220 | 120 - 1400 | 14 |

Years 1951-56

| Band | Sale Price Per Acre (Dollars) | | No. of Sales |
|---|---|---|---|
| | Mean Value Per Acre | Range | |
| A | 1155 | 348 - 5300 | 19 |
| B | 510 | 88 - 1750 | 12 |
| C | 288 | 140 - 1220 | 8 |
| D | 291 | 100 - 1500 | 12 |

Years 1957-62

| Band | Sale Price Per Acre (Dollars) | | No. of Sales |
|---|---|---|---|
| | Mean Value Per Acre | Range | |
| A | 1011 | 375 - 2460 | 11 |
| B | 597 | 260 - 2720 | 8 |
| C | ---- | ---------- | 4 |
| D | 407 | 150 - 1200 | 11 |

In order to test the validity of the use of assessments to infer land value, a number of parcels that had sold near the By-Pass were compared with their assessed valuation. Difficulty was encountered in making this comparison, as property is not assessed every year and there were insufficient numbers of sales in one year to make a satisfactory test of the method. Sales data were grouped around two assessment years in an attempt to obtain sufficient numbers for a comparison. These average sales were then compared with the assessed value for that period. A statistical linear regression and correlation was run on both sets of data. The resulting plots are shown in Figure 26. The regression line for the 1949 plot is:

Sale Price = \$3,100 + 1.30 (Assessed Value)

and the 1961 plot is:

Sale Price = \$2,550 + 1.46 (Assessed Value)

The correlation coefficients ( $r^2$) were 0.37 for 1949 and 0.38 for 1961, indicating very little apparent relationship between the mean sale price and the assessed value. After considering the variation in assessments from year to year and lack of correlation it was concluded that the assessment method would not provide meaningful results.

TABLE 5

ASSESSED VALUE OF LAND AND IMPROVEMENTS IN LEBANON AREA

| 1945 ASSESSMENTS | | |
|---|---|---|
| Township or City | Land Value | Improvements |
| Center | 2,105,600 | 948,090 |
| Eagle | 721,100 | 687,800 |
| Perry | 624,500 | 242,200 |
| Worth | 564,000 | 198,700 |
| Lebanon | 1,246,200 | 3,075,400 |
| Ulen | 29,700 | 177,600 |
| Zionsville | 140,600 | 569,600 |
| Whitestown | 25,400 | 176,100 |
| Boone County | 13,778,500 | 10,127,400 |

| 1962 ASSESSMENTS | | |
|---|---|---|
| Township or City | Land Value | Improvements |
| Center | 2,569,800 | 2,151,500 |
| Eagle | 1,097,700 | 2,577,000 |
| Perry | 787,000 | 508,100 |
| Worth | 682,500 | 527,600 |
| Lebanon | 2,131,900 | 7,834,300 |
| Ulen | 94,200 | 405,600 |
| Zionsville | 346,900 | 1,453,200 |
| Whitestown | 41,400 | 232,300 |
| Boone County | 18,382,700 | 23,831,900 |


FIGURE 26-A

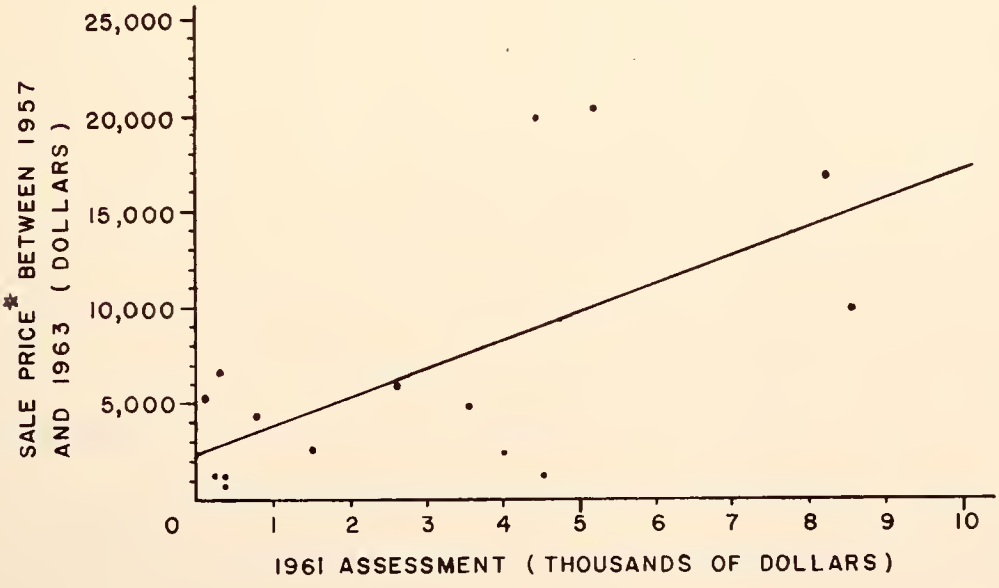



FIGURE 26-B

* VALUE DETERMINED FROM FEDERAL REVENUE STAMPS

CORRELATION OF PROPERTY ASSESSMENT AND SALE PRICE

## ANALYSIS OF RIGHT-OF-WAY COSTS FOR THE RECONSTRUCTION OF THE BY-PASS

It will be necessary to construct more and more urban by-passes because of motor vehicle volume increases and the growth of urban areas. Many of these will be for primary highways around small cities. Often these facilities warrant stage construction, with only two lanes of the proposed four-lane divided highway being completed during the initial stage. The intersections with existing highways are most often at-grade intersections although some minor roads may be dead-ended at the right-of-way line. Direct access from abutting property has been prohibited on by-passes built in recent years. Where no direct access of the abutting property is permitted, the Indiana State Highway Commission constructs an access control fence between the access points.

### Original By-Pass

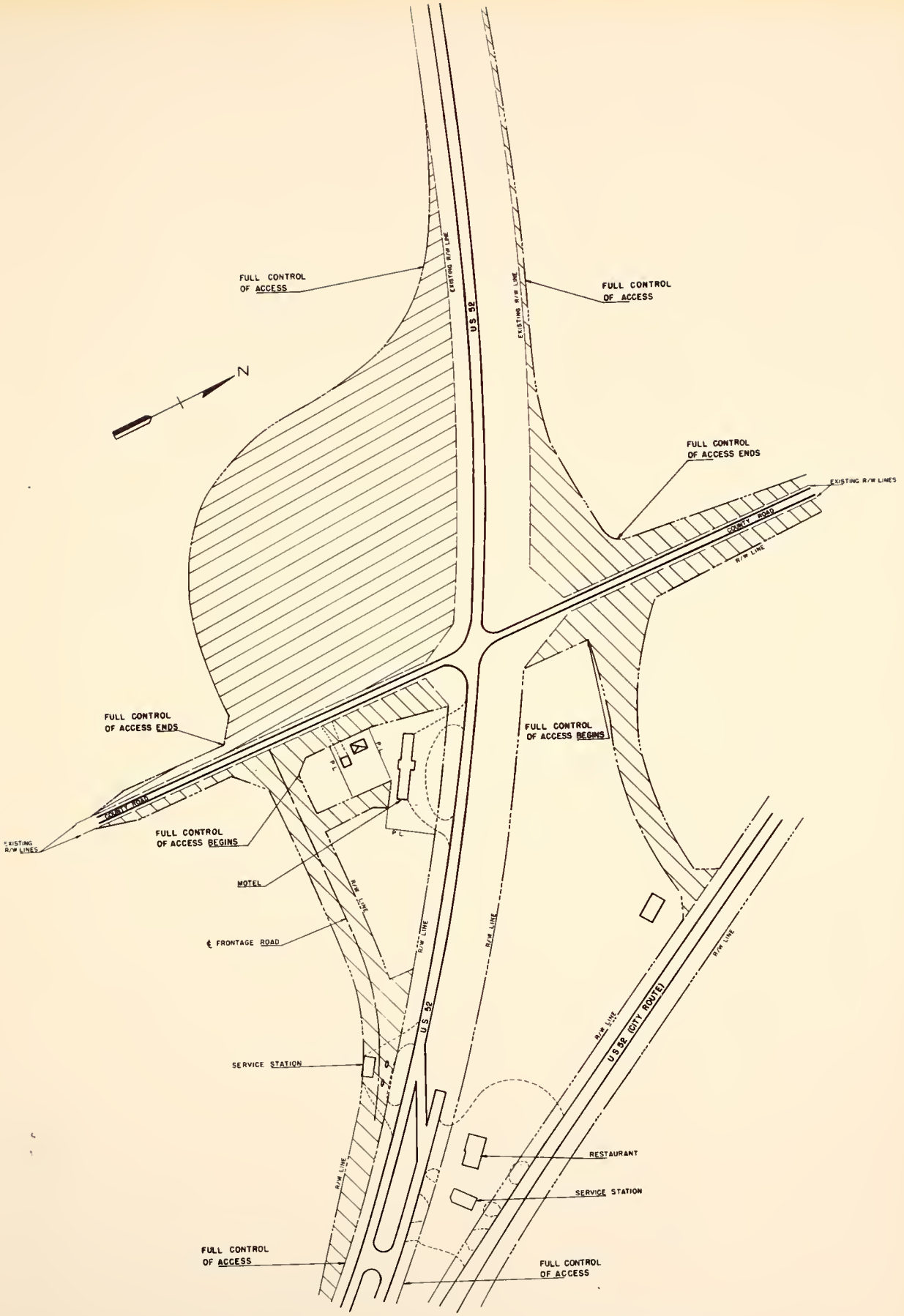
The right-of-way acquired for the construction of the U. S. 52 By-Pass at Lebanon passed through an area generally classified as farm land when it was purchased in 1947. Its location, however, was in close proximity to the city, especially at the junction with S.R. 39. Sufficient right-of-way was acquired at that time for the later construction of the second roadway of a four-lane divided facility. However, no provisions were made for any control of access and all existing roads (state highways as well as county roads) intersected at grade. It was planned that those intersections would continue to be at-grade when the second roadway was constructed.

The information contained in the files of the Division of Lane Acquisition shows that approximately 90 acres of right-of-way was acquired at an average unit price of $300 per acre and that the total right-of-way cost including improvements amounted to approximately $98,200.

## Reconstruction of By-Pass

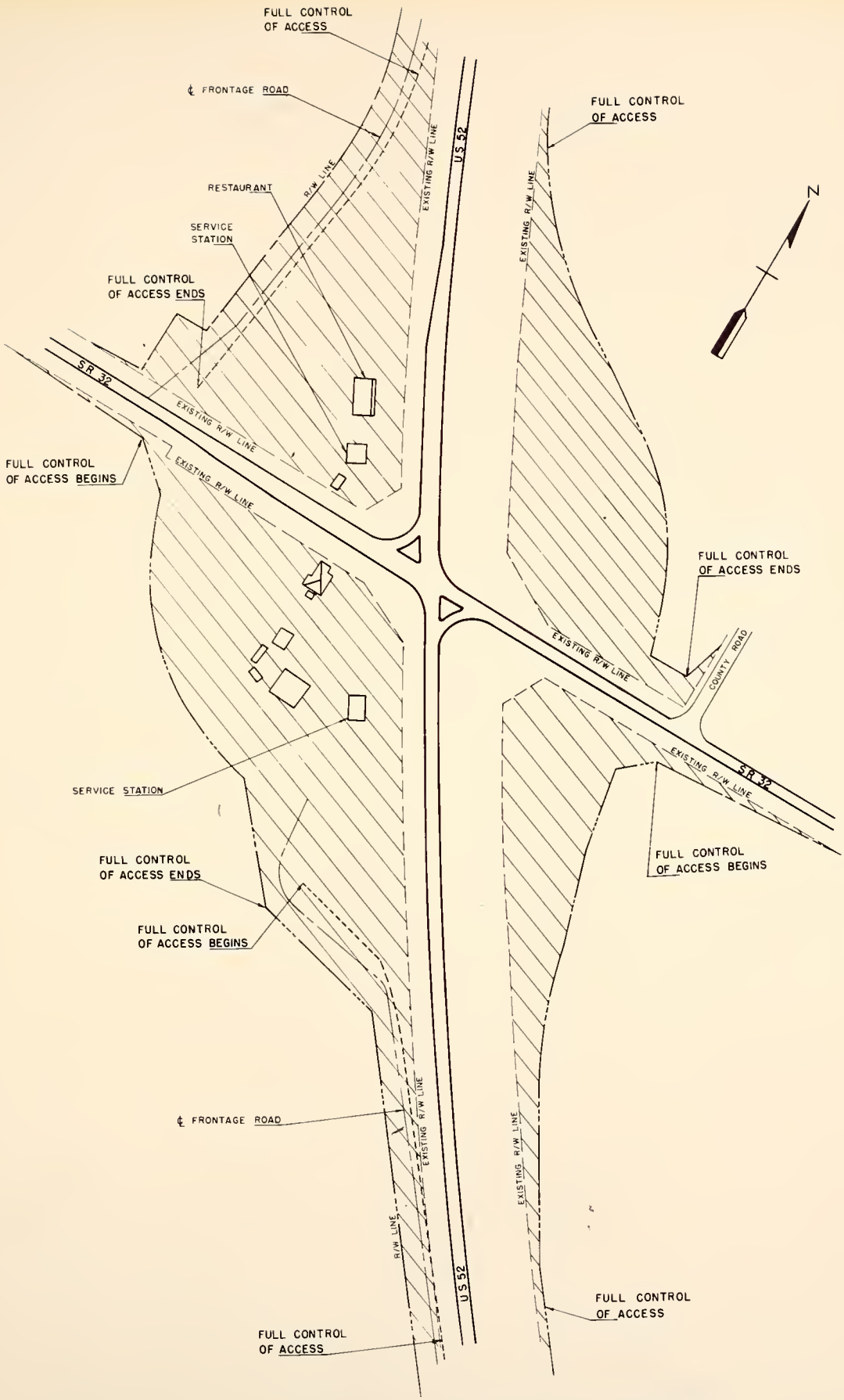
In 1958 an additional 75 acres of right-of-way were acquired for the reconstruction of the original by-pass to Interstate standards as a portion of I-65. At this time the fee appraisers valued the additional land at unit prices that ranged from a low of $400 per acre for agricultural land to a high of $40,000 per acre for a choice commercial location. The median unit value was $3,000 per acre. Subsequent to the construction of the original by-pass in 1949, several sizable improvements were added to the land that was required for the construction of the interchanges and frontage roads associated with the reconstruction to Interstate standards (see figures 27, 28, 29, and 30.) The depreciated value of these improvements in 1958 was estimated to be $299,800 by the state appraisers (see Table 6). The land was valued by these appraisers at $276,600. Thus, the total value of the additional right-of-way was estimated at $576,400. This same property could presumably have been acquired in 1947 for $300 per acre without improvements.

An added expense was incurred in 1958 by what are called "additional damages". A value of $147,300 was computed for the 1958 taking. This amount was obtained by comparing the appraised damages in 1958 to those that would have presumably been paid if full-control of access had been imposed at the time of the original construction. The additional damages to the land result from the increase in value of certain parcels after the original construction. The additional damages to improvements are the appraised value of the damages to those improvements that were constructed after the original by-pass was opened. It was assumed that the amount of damages to improvements that existed prior to this construction are about balanced by the damage appraisals made on these improvements in 1958.



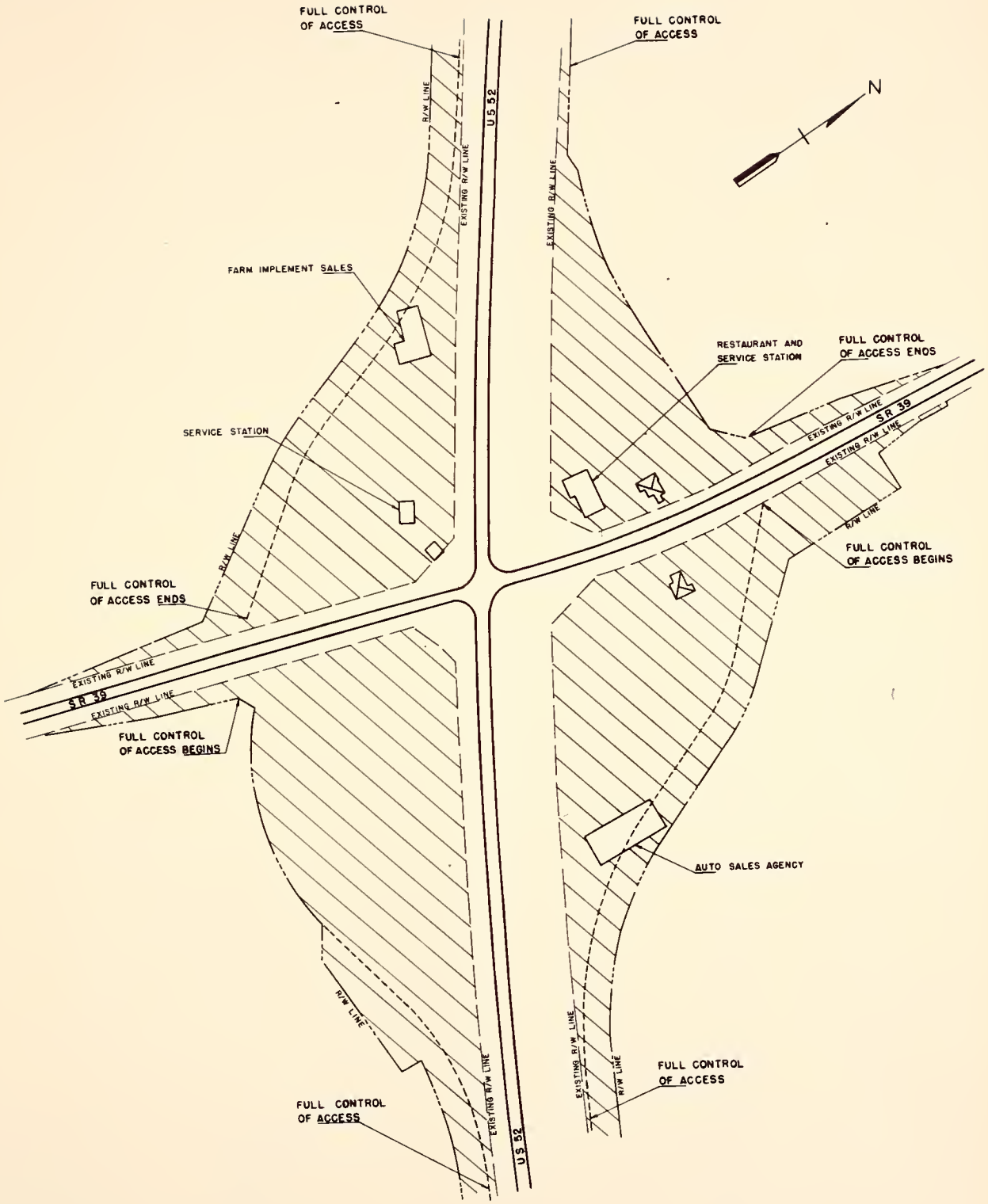

ADDITIONAL R/W REQUIRED FOR INTERCHANGE
ON SOUTH END OF BY-PASS

FIGURE 27



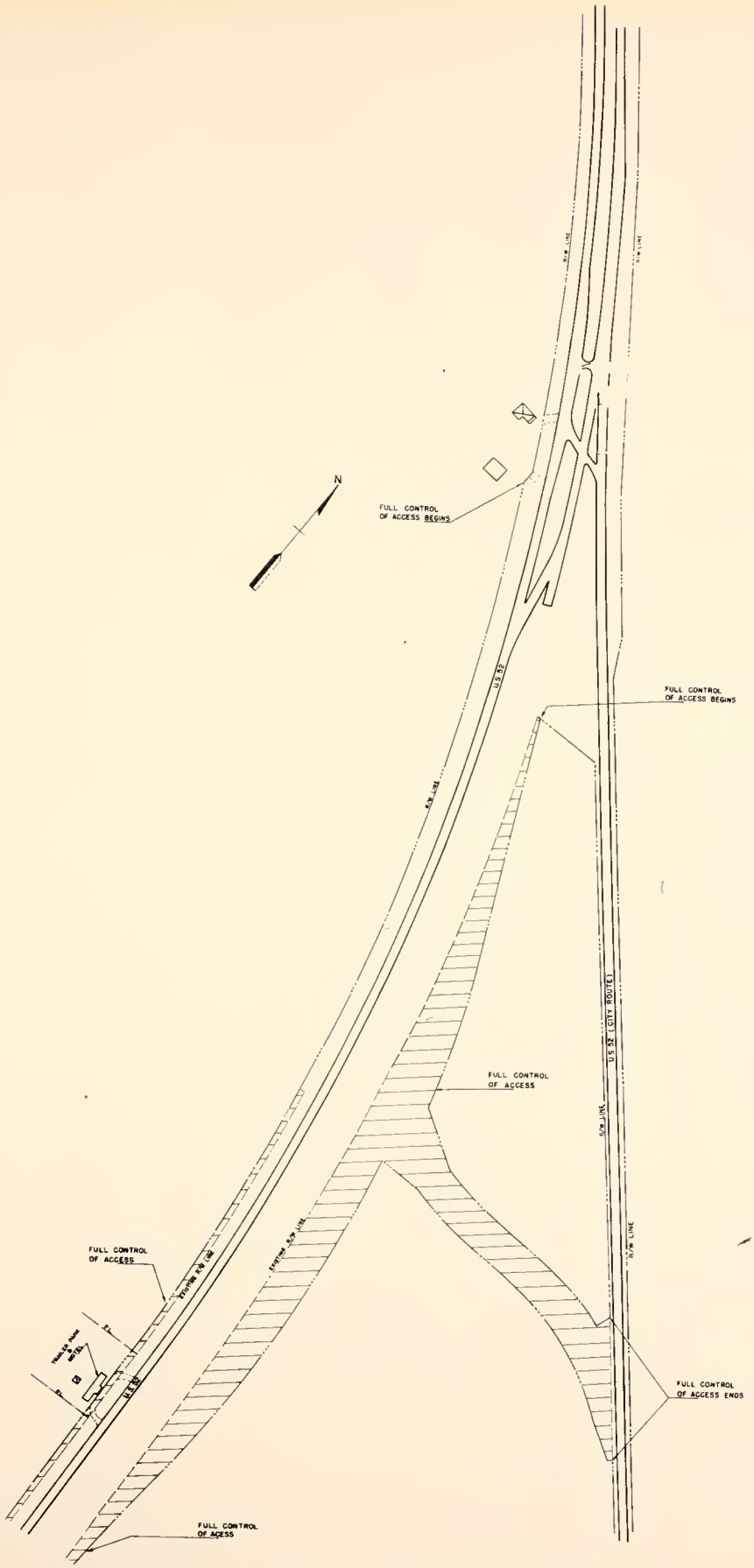

ADDITIONAL R/W REQUIRED FOR SR 32 INTERCHANGE

FIGURE 28




ADDITIONAL R/W REQUIRED FOR S R 39 INTERCHANGE

FIGURE 29




ADDITIONAL R/W REQUIRED FOR INTERCHANGE
ON NORTH END OF BY-PASS

FIGURE 30

The additional cost of the right-of-way is therefore estimated at approximately $701,000, calculated as follows:

| | |
|---|---|
| Value, additional land purchased in 1958 | $276,637 |
| Value, additional land if purchased in 1947 ($300/acre) | 22,700 |
| Additional cost of additional land (1947 to 1958) | $253,937 |
| Added improvements value (1947 to 1958) | 299,799 |
| Additional damages (1947 to 1958) | 147,355 |
| Additional R/W cost (1947 to 1958) | $701,091 |

If the same Right-of-Way had been purchased in 1947 with access control, assuming that damages paid in 1958 for access control and damages paid in 1958 for improvements existing on the property in 1947 would have been paid in 1947, the cost of the additional right-of-way in 1947 would have been as follows:

| | |
|---|---|
| Total appraised value of right-of-way 1958 | $875,424 |
| Additional R/W cost (1947 to 1958) | 701,091 |
| Total value of right-of-way 1947 | $174,333 |

If this amount ($175,000) had been used in 1947 to purchase the necessary right-of-way for this 4-lane, fully controlled access facility and assuming a rate of interest of 6 percent on this amount for eleven years (1947 to 1958) the savings to the state would have been as follows:

Compound interest factor for 11 years at 6% = 1.898

1947 right-of-way cost plus interest = $175,000 (1.898) = $332,000

Cost of additional R/W in 1958 (appraised value = $875,424

Projected Savings to Highway Commission = $543,000

TABLE 6

ANALYSIS OF RIGHT-OF-WAY COSTS FOR RECONSTRUCTION OF LEBANON BY-PASS

| | 1947 Acquisition For Original By-Pass | | | 1958 Acquisition for Reconstruction of By-Pass | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
| | Land Value | Land Payment | Total Payment | Additional Land Taken | Land Value | Value of Land Taken | Added Improvements | Additional Damages (1) | States Offer | Settlement or Court Award (4) | Additional Land at 1947 Value |
| Parcel No. | $/Acre | $ | $ | Acres | $/acre | $ | $ | $ | $ | $ | $ |
| 1 | 300 | 1,125 | 1,576 | | | (not included) | | | | | |
| 2 | 300 | 1,218 | 3,200 | | | | | | | | |
| 3 | 400 | 68 | 343 | | | | | | | | |
| 4 | | | | 3.85 | 1,000 | 3,850 | | 10,240 | 20,029 | 20,029 | 1,155 |
| 5 | 300 | 4,800 | 14,000 | 3.77 | 1,000 | 3,370 | | 200 | 10,010 | 10,010 | 1,131 |
| 6 | | | | 0.10 | 1,000 | 100 | | 48,550 | 51,046(2) | 56,066 (3) | 30 |
| 7 | | | | 8.19 | 1,000 to 20,000 | 64,770 | 65,340 | 21,955 | 164,065 | 368,179 | 2,457 |
| 8 | 300 | 2,958 | 6,500 | 0.11 | 1,000 | 110 | | | 885 | 3,500 | 33 |
| 9 | | | | (4063 Sq. ft.) | 3,000 | 406 | | 8,200 | 8,422 | 8,422 | 28 |
| 10 | | | | ( 500 sq. ft.) | 1,000 | 50 | | 885 | 935 | 10,250 | 15 |
| 11 | | | | 2.94 | 3,000 to 25,000 | 27,820 | | 9,230 | 37,050 | 385,000 | 882 |
| 12 | 300 | 2,021 | 9,544 | 6.88 | 20,000 | 25,000 | 27,605 | | 75,179 | 176,729 | 2,064 |
| 13 | | | | 0.36 | 3,000 | 8,649 | | 6,345 | 8,649 | 26,879 | 108 |
| 14 | 300 | 96 | 300 | 2.14 | 700 | 1,480 | | | 1,930 | 6,489 | 642 |
| 15 | 300 | 3,700 | 11,100 | 0.81 | 400 | 324 | | | 324 | 14,199 | 243 |
| 16 | 300 | 438 | 950 | 0.61 | 400 | 244 | | | 244 | 1,341 | 183 |
| 17 | 300 | 1,560 | 4,122 | 2.34 | 400 | 928 | | 2,410 | 3,500 | 3,500 | 702 |
| 18 | 300 | 531 | 2,410 | 2.76 | 3,200 | 8,832 | | 2,180 | 21,632 | 21,632 | 828 |
| 19 | 300 | 50 | 75 | 0.18 | 2,000 | 360 | | 700 | 11,153 | 11,153 | 54 |
| 20 | 300 | 165 | 4,500 | 1.09 | 10,000 | 10,900 | 54,655 | | 65,905 | 82,130 | 327 |
| 21 | | | | 0.98 | 30,000 | 30,000 | 62,329 | | 92,329 | 164,137 | 180 |
| 22 | | | | 0.04 | 3,500 | 140 | | | 1,505 | 1,505 | 12 |
| 23 | | | | 1.26 | 3,000 | 3,780 | 43,680 | 2,990 | 50,450 | 106,650 | 378 |
| 24 | 300 | 1,380 | 14,250 | 0.57 | 40,000 | 22,800 | | | 22,800 | 30,000 | 171 |
| 25 | | | | 3.37 | 11,200 | 38,200 | 23,790 | 6,850 | 68,840 | 120,500 | 1,011 |
| 26 | | | | 0.03 | 2,500 | 75 | | | 115 | 115 | 9 |
| 27 | 300 | not involved | | 0.06 | 400 | 24 | | | 76 | 76 | 18 |
| Subtotals | | 20,110 | 72,870 | 42.16 | | 252,212 | 274,399 | 120,735 | 717,073 | 1,628,491 | 12,661 |

TABLE 6 ( cont. )

ANALYSIS OF RIGHT-OF-WAY COSTS FOR RECONSTRUCTION OF LEBANON BY-PASS

| | 1947 Acquisition For Original By-Pass | | | 1958 Acquisition for Reconstruction of By-Pass | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
| | Land Value | Land Payment | Total Payment | Additional Land Taken | Land Value | Value of Land Taken | Added Improvements | Additional Damages (1) | States Offer | Settlement or Court Award (4) | Additional Land at 1947 Value |
| Parcel No. | $/Acre | $ | $ | Acres | $/acre | $ | $ | $ | $ | $ | $ |
| 28 | 300 | 3,210 | 13,000 | 1.93 | 450 | 868 | | 9,000 | 10,268 | 10,268 | 579 |
| 29 | | | | 0.15 | 4,000 | 600 | | 2,500 | 3,100 | 3,100 | 45 |
| 30 | | | | 16.88 | 450 | 7,596 | | | 19,096 | 19,096 | 5,064 |
| 31 | | | | 0.50 | 3,300 | 1,650 | | 35,000 | 37,350 | 80,768 | 150 |
| 32 | 300 | 4,995 | 12,000 | 0.12 | 3,000 | 360 | | 10,270 | 10,630 | 14,642 | 36 |
| 33 | | | | 1.66 | 3,000 | 4,980 | | 1,350 | 6,480 | 6,480 | 450 |
| 34 | 300 | 120 | 362 | 0.15 | 500 | 75 | | | 267 | 267 | 45 |
| 35 | 300 | not involved | | 0.74 | 500 | 370 | | | 6,963 | 10,000 | 222 |
| 36 | 300 | not involved | | 0.75 | 5,000 | 3,750 | 25,400 | | 34,925 | 34,925 | 225 |
| 37 | 300 | not involved | | 10.44 | 400 | 4,176 | | | 29,272 | 41,416 | 3,132 |
| Totals | | 28,435 | 98,232 | 75.48 | | 276,637 | 299,799 | 147,355 | 875,424 | 1,849,453 | 22,609 |
| | | | | Cost of additional fee and court appraisals | | | | | 15,640 | 15,640 | |
| | | | | | | | | | 891,064 | 1,865,093 | |

(1) "additional damages" were considered to be damages to improvements that were constructed after 1947, damages due to a loss of access to US 52, and the difference in the dollar amount of damages based the difference in 1947 and 1958 land.
(2) The states last offer was $52,800
(3) amount of jury award
(4) Court Appraisals are given in many cases as a number of cases have not as yet been finally settled.

The total saving to the State of Indiana would have been even greater than indicated if the additional administrative costs had been considered. The cost of making additional fee and court appraisals was $15,600 for this highway improvement. Also to be considered are the administrative time, the operations of the Deputy Attorney Generals Office in condemnation cases (which average approximately $1000 per case) and court costs.

The amount of the court appointed appraisals (court award) has not been utilized in the analysis because the situation in Boone County is not considered a "normal" taking. The wide discrepancy between the States offer and the court appointed appraisers "estimates" should be noted. The amounts of the final settlements will not be known until many of the cases come to jury trial, but past history would indicate that the settlements can be expected to exceed the State's offer in most instances. For this reason the savings of $543,000 can be considered a minimum figure.

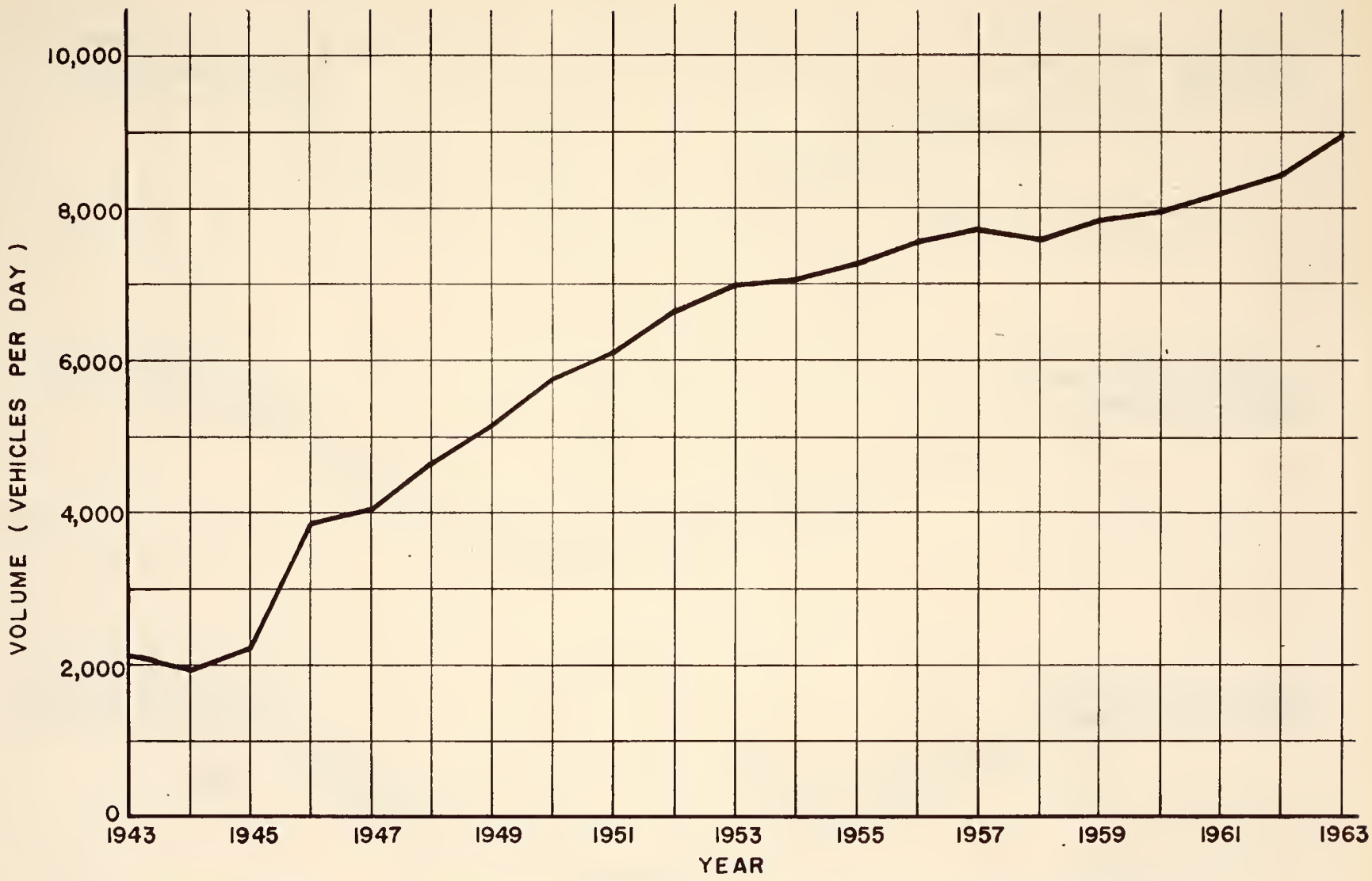
## TRAFFIC VOLUME

The purpose of a by-pass is to move through traffic around rather than through a city, and thus avoid the delay, congestion, and high accident rates caused by the overcrowding of streets which are not designed to carry high volumes. Given an alternate route, such as a by-pass, the majority of traffic will use the facility only if it provides a saving in time and/or comfort. A study of traffic volumes and volume changes aids in determining how travel patterns are altered by improving and adding new traffic facilities.

Traffic volumes on U.S. Highway 52 are shown in Figure 31. These data are from an automatic traffic recording station located about sixteen miles north of Lebanon. Though this station does not record By-Pass traffic it does show the trend in volumes on U.S. 52. Volumes on the By-Pass are shown in Figure 32.

Prior to the construction of a by-pass, the major flow of external traffic through Lebanon was on U.S. 52 as shown in Figure 33. State Route 39 contributed some congestion, in that it crossed U.S. 52 in the center of the business district. State Route 32 did not appear to cause much congestion in the urban area.

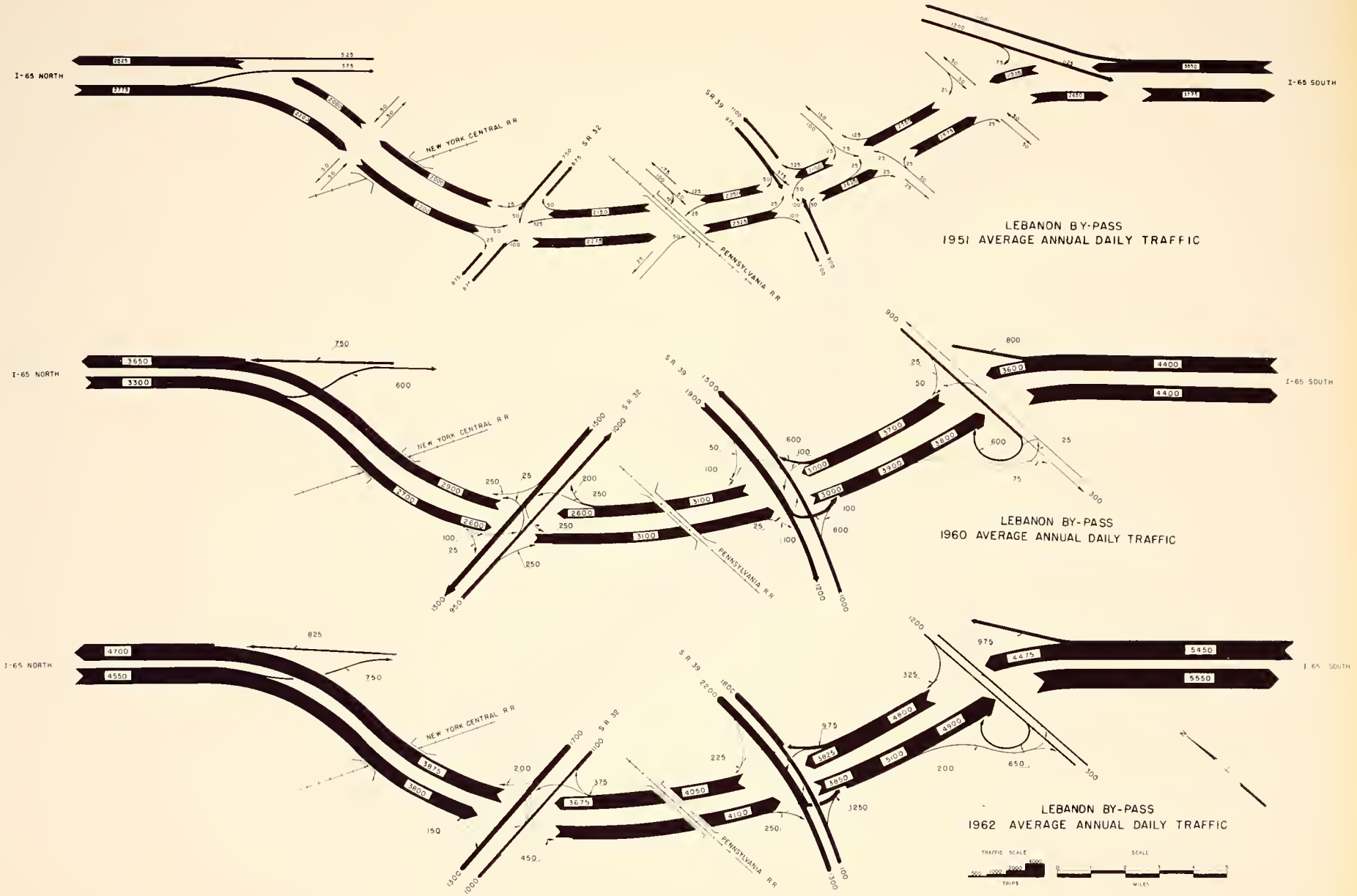
After the By-Pass was constructed, U.S. 52 traffic was diverted from the city route, intersecting both SR 32 and SR 39 at rural intersections (see Figure 34). This change greatly relieved the congestion that had previously delayed traffic within the city. The traffic volumes of SR 32 and SR 39 were not appreciably affected by the diversion. The rural nature of the By-Pass intersections with SR 32 and SR 39 and the increasing volumes both on the State routes and on the by-pass led to the installation of traffic signals at these intersections two years after the facility opened.




TRAFFIC VOLUMES ON U.S. HIGHWAY 52 AT S.R. 28 INTERSECTION

( DATA FROM I.S.H.C. A.T.R. STATION 42-A )

FIGURE 31




TRAFFIC VOLUMES ON LEBANON BY-PASS
FIGURE 32


SR 39
TRAFFIC FLOW AT LEBANON
PRIOR TO CONSTRUCTION OF BY-PASS
1950
US 52
5000
2500
1250
VEHICLES PER 24 HRS.
SR 32
N
SR 32
US 52
SR 39

FIGURE 33

Traffic volumes continued to rise on the By-Pass. By 1957 the volume on the two-lane facility was rapidly approaching congestion, accident rates were high, and travel times were approaching those on the city route. In general, the facility was beginning to lose its usefulness as a by-pass.

The decision to reconstruct the By-Pass as a part of I-65 resulted in the elimination of the congestion conditions that were affecting its usefulness. Access control eliminated eight at-grade intersections and replaced them with four interchanges. The resulting volume conditions indicate that a number of changes have occurred in the travel pattern (see Figure 32). The I-65 through traffic continues to use the By-Pass as shown in Figure 35. One of the noticeable changes, however, is that the SR 39 interchange has apparently replaced the city route of US 52 as the major south entrance to Lebanon. Entrance to the city on SR 39 might indicate that the drivers are missing the I-65 business loop exit, and thus use the next interchange. However, examination of the turning movements at the SR 39 interchange indicate that the majority of traffic using the ramps are either entering the city from I-65 northbound or leaving the city on I-65 southbound. The distribution of these turning movements would tend to indicate that local drivers prefer this interchange to the designated business loop. Further indication of this fact is that the volume on the business loop has decreased 30 percent since 1951 while the turning movements at SR 39 have increased almost 300 percent (see Figure 32).

A considerable increase in volume at the SR 32 interchange has also taken place. Indications at this interchange are that although the number of turning movements have greatly increased, the majority of all increases have been caused by an increase in the volume of traffic on SR 32. A build up of commercial and industrial areas westward along state route 32 has

# TRAFFIC FLOW AT LEBANON AFTER THE CONSTRUCTION OF 2-LANE BY-PASS

1951


FIGURE 34

TRAFFIC FLOW AT LEBANON AFTER RECONSTRUCTION OF BY-PASS TO INTERSTATE STANDARDS

1960

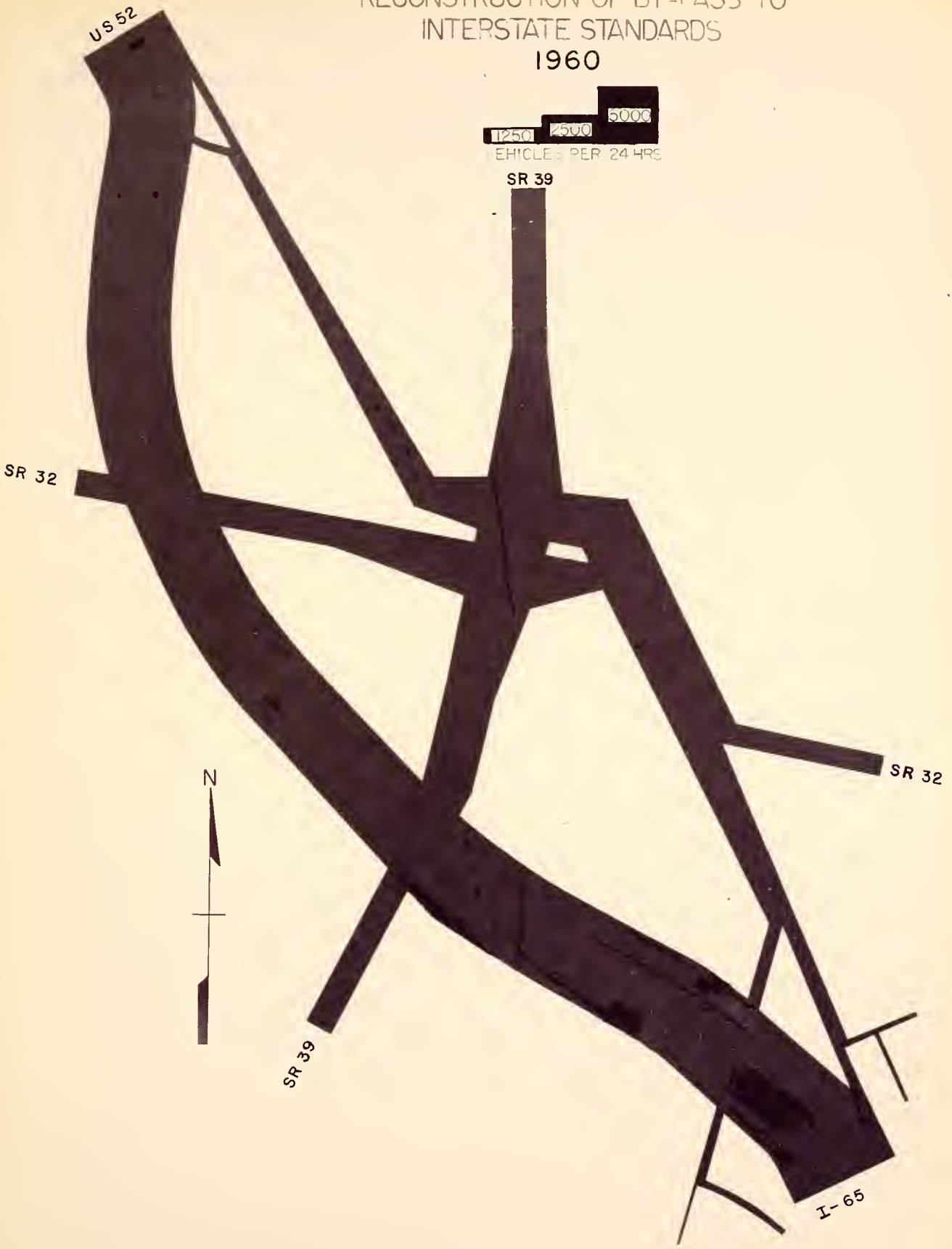



FIGURE 35

contributed to this increase in traffic volume.

Another point that is noted in the travel patterns is that a greater percentage of vehicles enter and leave the city on the south than on the north. This can be explained by the fact that the city of Indianapolis exerts an influence on the travel patterns of Lebanon. Many of the citizens of Lebanon are employed by firms in Indianapolis and consequently travel to and from work daily.

## TRAVEL TIME

Prior to 1951 and the opening of the By-Pass, the route followed by U. S. 52 through Lebanon was devious and time-consuming. One "stop" street, two traffic signals, several railroad crossings and an area of industrial buildings along the route created a great deal of delay. A summary of the travel time data obtained on the U.S. 52 business route prior to the original construction of the By-Pass as well as subsequent data for the By-Pass is shown in Table 7. This data indicates that through traffic saved slightly over four minutes in travel time when the original by-pass was opened in May 1951. However, this saving in time had decreased to three minutes by mid 1957. The installation of traffic signals at State Routes 32 and 39 intersections early in 1952 caused most of the additional delay. The signals were installed to reduce the accident rate at these intersections.

The By-Pass was reconstructed as part of Interstate 65 and both roadways opened to traffic in 1959. Following the reconstruction to interstate standards, traffic has been able to move freely, as the volume has been considerably below that level at which significant interference is encountered. Because of the free movement it is believed that average spot speeds at several locations might be a better indication of the speed at which drivers travel. The total travel times shown in Table 7 for the years 1960 and 1964 were calculated from these average speeds.

TABLE 7

COMPARISON OF TRAVEL TIMES AND AVERAGE OVER-ALL SPEEDS ON U.S. 52 AT LEBANON

| | TRAVEL TIME | | | | AVERAGE OVER-ALL SPEED MPH |
|---|---|---|---|---|---|
| | Time Stopped | | Total Time | | |
| | min. | sec. | min. | sec. | |
| Before Construction of By-Pass 1950 U.S. 52 | 1 | 10 | 9 | 55 | 30 |
| After Construction of By-Pass U.S. 52 Business Route, 1951 | 0 | 22 | 8 | 54 | 34 |
| U.S. 52 By-Pass in 1951 (a) | none | | 5 | 54 | 52 |
| in 1957 | 0 | 27 | 6 | 56 | 44 |
| in 1960 (b) | none | | 4 | 50 | 63 |
| in 1964 | none | | 4 | 50 | 63 |

(a) Approximately six months after the opening of the original by-pass.

(b) Approximately nine months after the reconstruction of the by-pass to interstate standards.

Note: By-Pass Length is 4.9 miles.

Present travel time on the By-Pass appears to be a matter of driver preference. The only observed difference between vehicle operation on the By-Pass and vehicle operation on the rural sections of the Interstate is a slight reduction of speed of through vehicles while they are on the By-Pass. This reduction may be influenced by the existance of the four interchange areas.

## Accident Analysis

A study was made of all accidents which occurred on the Lebanon By-Pass during two twenty-four month periods. The first period, from May 1, 1956 to April 30, 1958, considered the operation of the original two lane by-pass, with signalized at-grade intersections. This period was five years after the opening of the original By-Pass and six months prior to the beginning of construction to interstate standards. The second period, from January 1, 1961 to December 31, 1962, considered the operation of the reconstructed facility. This period was six months after the reconstructed facility was opened to traffic.

The analysis of accidents occurring on the Lebanon By-Pass was made on an economic basis. The official reports of all accidents occurring on the By-Pass within the two twenty-four month periods being considered were obtained from the Indiana State Police Division of Accident Records. These accident reports were examined to ascertain the type, location, and the estimated property damage resulting from each accident. Personal injuries and fatalities involved in each accident were also established, and these were assigned valuations based on the following figures (1):

Personal injury - $660 per person injured

| Fatality | Cost per person | |
|---|---|---|
| Age | Male | Female |
| 0-14 years | $17,000 | $ 8,000 |
| 15-55 years | $29,000 | $17,000 |
| 56 years and older | $ 5,000 | $ 3,500 |

These valuations were assigned to personal injuries and fatalities in both the before and after periods.

In the period before reconstruction of the Lebanon By-Pass there was a total of 113 accidents, including 2 fatalities and 38 personal injuries, representing a cost of $173,677.00. In the period after reconstruction of the Lebanon By-Pass to interstate standards, there was a total of 27 accidents including 2 fatalities and 46 personal injuries, representing a cost of $48,460.00 as shown in Table 8 and Figure 36.

For comparison purposes, the accidents occurring during the two periods were also classified according to the following four categories, as recommended by Maxwell Halsey (9):

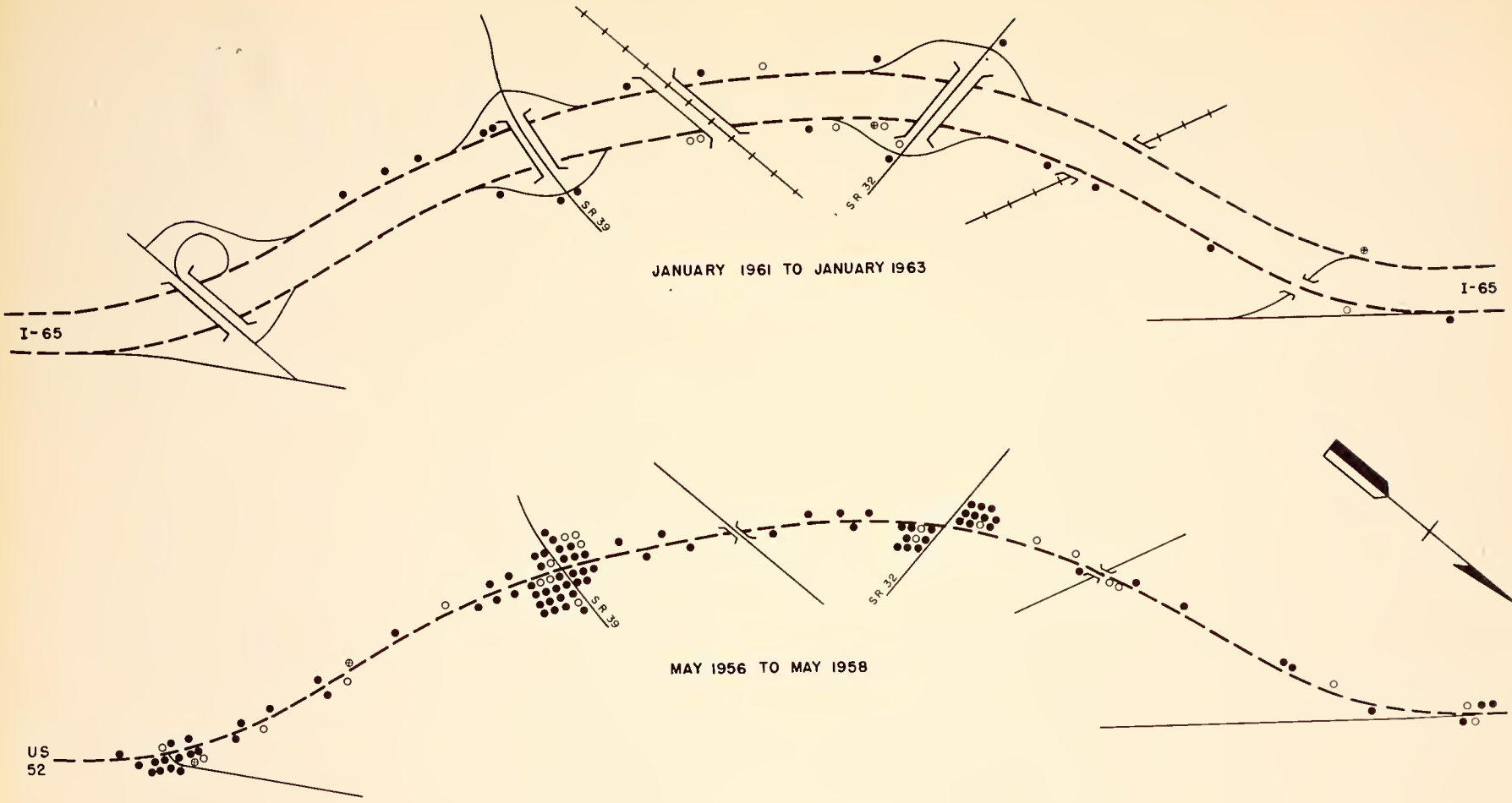
Type I - Intersection accidents which occur at the crossing of two traffic streams. These accidents are typically right-angle, turning and rear-end collisions.

Type II - Marginal accidents which occur along the moving edge of a traffic stream. These accidents result from vehicles attempting to enter or leave the moving stream. Typical accidents are rear-end collisions.

Table 8

## ACCIDENT COSTS ON LEBANON BY-PASS

| Before Reconstruction | | After Reconstruction | |
|---|---|---|---|
| **TOTALS** | | | |
| 2 Fatalities | - $ 46,000 | 2 Fatalities | - $ 20,050 |
| 38 Personal Injuries | - $ 25,080 | 16 Personal Injuries | - $ 10,560 |
| 113 Property Damages | - $102,597 | 27 Property Damages | - $ 17,400 |
| | $173,677 | | $ 48,460 |
| **TYPE I** | | | |
| 0 Fatalities | - $ 0 | 0 Fatalities | - $ 0 |
| 18 Personal Injuries | - $ 11,880 | 0 Personal Injuries | - $ 0 |
| 66 Property Damages | - $ 36,492 | 3 Property Damages | - $ 320 |
| | $ 48,372 | | $ 320 |
| **TYPE II** | | | |
| 1 Fatality | - $ 17,000 | 0 Fatalities | - $ 0 |
| 3 Personal Injuries | - $ 1,980 | 2 Personal Injuries | - $ 1,320 |
| 17 Property Damages | - $ 10,755 | 9 Property Damages | - $ 3,165 |
| | $ 29,735 | | $ 4,485 |
| **TYPE III** | | | |
| 0 Fatalities | - $ 0 | 0 Fatalities | - $ 0 |
| 7 Personal Injuries | - $ 4,620 | 0 Personal Injuries | - $ 0 |
| 13 Property Damages | - $ 23,430 | 0 Property Damages | - $ 0 |
| | $ 28,050 | | $ 0 |
| **TYPE IV** | | | |
| 1 Fatality | - $ 29,000 | 2 Fatalities | - $ 20,050 |
| 10 Personal Injuries | - $ 6,600 | 14 Personal Injuries | - $ 9,240 |
| 17 Property Damages | - $ 31,920 | 15 Property Damages | - $ 13,915 |
| | $ 67,520 | | $ 43,655 |




## LEGEND

- ● PROPERTY DAMAGE ACCIDENT
- ○ PERSONAL INJURY ACCIDENT
- ⊕ FATAL ACCIDENT

# ACCIDENT LOCATION MAP OF LEBANON BY-PASS

0 1200 2400 3600

| ACCIDENTS | 1956-58 | 1961-63 |
|---|---|---|
| PROPERTY DAMAGE | 113 | 27 |
| PERSONAL INJURY | 38 | 16 |
| FATAL ACCIDENT | 2 | 2 |
| TOTALS | 153 | 45 |

FIGURE 36

Type III - Medial accidents which occur between vehicles moving in opposite directions. Head-on collisions and side-swipes are typical accidents of this type.

Type IV - Internal stream accidents which occur among vehicles moving in the same direction. These include such miscellaneous accidents as running off the road, overturning and some rear-end collisions. This type of accident will occur on any facility.

During the before period, there were no fatalities, 18 personal injuries and 66 property damage accidents of Type I, costing $48,372.00. During the after period, there were no fatalities, no personal injuries and 3 property damage accidents of Type I, costing $320. Type I includes accidents which occurred at the intersection of the diamond interchange ramps with the two state routes which cross over the by-pass. This remarkable reduction in the number and severity of accidents of this type can be attributed to grade separated interchanges used to pass the two state routes over the by-pass.

Type II accidents during the before period included 1 fatality, 3 personal injuries and 13 property damage accidents, costing $29,735.00. Type II accidents during the after period included no fatalities, 2 personal injuries and 7 property damage accidents, costing $4,485.00. The provision of acceleration and deceleration lanes, facilitating entry into and exit from moving traffic streams served to reduce the number of accidents of this type by approximately 50%.

Accidents classified as Type III occurred in the before period 13 times; these included no fatalities, 7 personal injuries and 13 property damage accidents, costing $28,050.00. Accidents classified as Type III were completely eliminated in the after period as a result of the provision of two lanes of travel in each direction with a fifty foot median divider.

Type IV accidents in the before period included 1 fatality, 10 personal injuries and 6 property damage accidents, having a total cost of $67,520.00. Type IV accidents in the after period included 2 fatalities, 14 personal injuries and 15 property damage accidents, having a total cost of $43,655.00. As might be expected, accidents of this type which will occur on any type facility were not reduced by the improvements to the By-Pass.

The above comparisons show that Type I and Type III accidents were, for all intents and purposes, eliminated from the Lebanon By-Pass by the reconstruction of the facility. Similarly, Type II accidents were drastically reduced. This improvement in the safety of the By-Pass is directly attributable to the improved design elements incorporated in the new facility.

On the Lebanon By-Pass during the two periods studied, accidents on the two lane facility represented a loss of $173,677.00 and on the four lane divided facility the total loss from all types of accidents was $48,460.00. Average loss per year on the 2-lane highway was $86,838, and on the 4-lane, limited access highway was $24,230. The average yearly savings resulting from the reconstruction of the By-Pass is $62,608 based on this 2-year experience.

## SUMMARY

The results determined from the data accumulated to 1963 on this study are summarized as follows:

1. The overall pattern of land use in the Lebanon area was only slightly altered by the By-Pass. The facility acted as a mild stimulant to highway oriented commercial development, but at the same time became a natural barrier to residential land development southwest of the city.
2. The location of a railroad embankment along the west edge of the City has acted as a natural barrier to expansion in that direction. Thus development which might have been stimulated by the By-Pass in this area has, for the most part, been held in check by the railroad embankment.
3. Prior to the reconstruction of the facility, highway oriented commercial development comprised the major portion of the land use changes along the By-Pass. The purchase of additional right-of-way for the interchanges eliminated most of this development. Limited industrial and commercial land developments presently are occurring slowly in the interchange areas.
4. The analysis of land value indicates that land values within one-half mile of the By-Pass were particularly sensitive to the construction and reconstruction of the facility. The increase in value of land as noted for property near the By Pass appears to have extended to more than one mile on either side of the facility. Land close to the By Pass experienced a rapid and considerable increase in value immediately following construction of the non-limited access facility but this increase sustained a dampening affect upon reconstruction of the facility to interstate standards.

5. Assessed valuation proved to be an inadequate method of determining trends in land value for this particular facility.

6. Analysis of right-of-way costs for the reconstruction of this By-Pass indicates that:

   a) If access control will ever be desirable or necessary, it should be imposed as part of the original right-of-way acquisition; and

   b) If it is anticipated that traffic volumes will ever reach the point where grade separations and/or interchanges are warranted, the right-of-way required for these structures should be acquired at the time of the original taking.

7. The study of traffic volumes, travel times, and accident rates indicates construction of the original By-Pass proved to be only a temporary elimination of congestion for the traffic on U.S. 52. Increasing traffic volumes and commercial land development along the 2-lane non-limited access resulted in increasing congestion and high accident rates. The reconstruction of the facility to Interstate standards eliminated virtually all of the congestion and greatly reduced the accident rate.

8. A study of the turning movements at the By-Pass interchanges indicates an alteration of the driving habits of Lebanon Bound vehicles. Prior to reconstruction the majority of the vehicles entering and leaving the City used the U. S. 52 city route. Since the facility was reconstructed the major entrance to the city has become the State Route 39 interchange.

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